UNITED STATES ARMY

DECEMBER 1972

AVIATION DIGEST

UNITED STATES ARMY AVIATION DIGEST

DECEMBER 1972 VOLUME 18 NUMBER 12

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ABOUT THE COVER

As Army aviation celebrates its 30th Christmas, Lieutenant General John J. Tolson takes a look back and a look ahead. See page 2

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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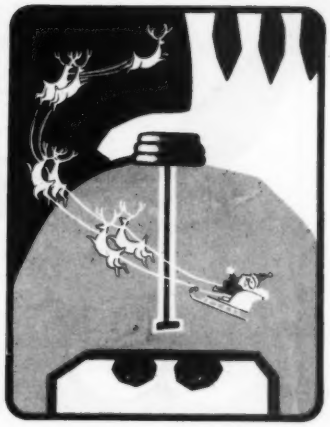
IEWS ROM EADERS



Sir:

It was noted with interest the article entitled "Another Helicopter Concept" in your April 1972 issue.

This is not a new concept to the Army. A system was designed by the U. S. Army Weapons Command and contractors who became combat operational in RVN in the latter months of 1968. The system utilized eight 40 mm XM-129 grenade launchers firing downward from the bombay of a modified Navy P2V Neptune. The modified plane was a platform for and included operation of other Navy gear. Personal knowledge resulting from a trip to RVN by this writer in early 1969 showed the system to be a unique concept of firepower yielding extremely favorable results. Upon returning to CONUS, an effort was undertaken to design a similar downfire system for the Army utilizing armored Chinooks (see photograph). With the capabilities of the CH-47, a concept of 16 to 20 launchers was envisioned. As an example, assume a speed of 175 knots at 100 feet altitude. The launchers are set at fixed angles firing through ports in the bottom of the ship so that the burst pattern overlaps to give saturation levels depending upon the altitude. The 20 weapons firing at the rate of 8,000 SPM would yield a swath 340 feet wide for a length of 11,800 feet. The implications are apparent. As a safety factor, a rear firing .50 caliber was to be used. Since the system was already combat proven, the weapon control and ammo container all designed and built, and the aircraft existing, the effort to marry up the two was considered to be minimal in cost to achieve a prototype.

John S. Hathaway
Mech Engr Tech
Rock Island, IL 61201

Sir:

I would like to share a point that relates both to CPT William D. Bristow's article, "On Fire And Going Down" (DIGEST, May 1971) and to my article "The Extra Step" (DIGEST, September 1972).

The day Dave Bristow went down in flames brings out the point I was trying to make through my article. On that day Dave was flying one of my aircraft and had borrowed my "chicken plate."

As you will recall from his article, Dave's aircraft was completely engulfed by flames as soon as it touched down, and the crew escaped with minor burns. However, the only survival equipment they had was the gear secured to my chicken plate. The undergrowth was so thick rescue aircraft did not see the

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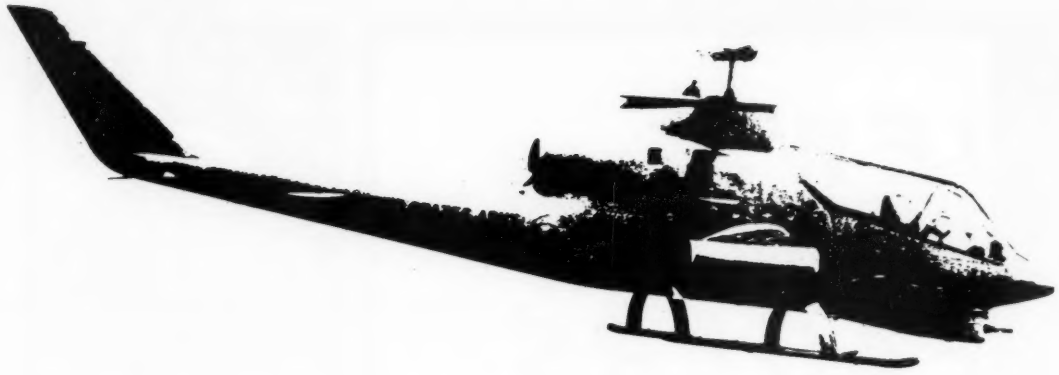


The New Challenge

A new era of Army aviation is upon us. We now have air-minded, airmobile commanders with extensive combat experience in Vietnam behind them. They will never be satisfied without a "Three Dimension Army," which they will adapt to situations facing them

Lieutenant General John J. Tolson
Deputy Commanding General
United States Continental Army Command

ARMY AVIATION celebrates its 30th Christmas this month standing at the threshold of a new era. This is signaled by the redistribution of Army aircraft in the wake of the winddown in the Republic of Vietnam. Other actions also are being taken to assure that Army aviation's full potential will be available and ready for any future conflict.

The mission of Army aviation—to support the ground soldier—was put to the ultimate test in Vietnam and became *essential* to the Army's role in conducting land combat. In fact, Army aviation has added the third dimension to the functions of land combat, as illustrated in figure 1.

There was a rapid increase in the number of Army aviation units in Vietnam between fiscal years 1965 and 1969-1970. An even sharper decrease occurred thereafter (figure 2). As you can see, Army aviation grew into a veritable giant by 1969 and has since wound down as the U. S. disengages in that theater.

As our combat role ceases, we must focus on the future of Army aviation. Certainly the main concern for Army aviation is the mid- to high-intensity European battlefield. In this connection we must ask ourselves what is the best mix of Army units to be employed against a future adversary? We do not yet have the answers to these questions. However, when tests of the TRICAP Division and other MASSTER evaluations at Ft. Hood, TX, are completed, we should have learned considerably more on how Army aviation can operate and survive in a mid-intensity conflict.

Five Functions Of Land Combat

Figure 1

To fill the personnel requirements generated by the tremendous growth that Army aviation has undergone over the past decade, more than 32,000 aviators were trained. The Army's aviator strength reached its peak in 1969-1970 when the total on active duty exceeded 24,000.

The drawdown in Vietnam has resulted in the rapid redistribution of modern aircraft assets throughout the Army. Preferred assets such as the UH-1H, OH-58, AH-1G, CH-54A/B and CH-47B/C are being assigned to meet most requirements. As an example, 1,097 new production and overhaul aircraft have been assigned to the Continental Army Command (CONARC) during the past fiscal year. These qualitative improvements have enabled us to eliminate 1,288 older, obsolete and nonstandard types of aircraft from our inventory (fixed wing types include the O-1, U-6, U-1A, U-10, C-45 and C-47; rotary wing types are the OH-13, OH-23, UH-1B/C/M, UH-1D, CH-54 and TH-55).

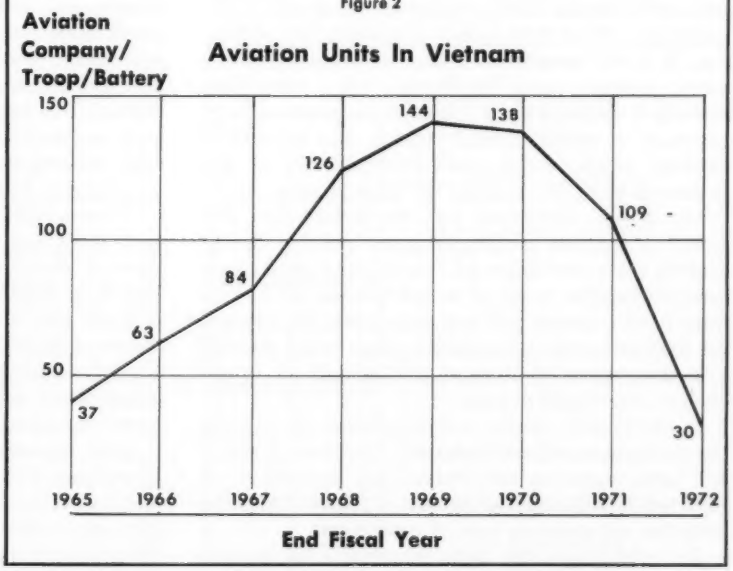
Essentially this is a modernization program through which we hope to tidy up the system by minimizing the number and types of aircraft and by phasing out low density types as well as the older nonstandard aircraft. We expect to standardize our light observation helicopters with OH-58s; our attack helicopters with AH-1Gs our CH-47 fleet with CH-47B/Cs and our Huey fleet with UH-1Hs.

Along with the reduction of wartime activity in Vietnam comes a reduction in funding. We in the

Continued on page 15

This article was adapted from a speech recently delivered by LTG Tolson

Figure 2



This is the first in a series of three articles about the effects of changing barometric pressure on the human body

Aeromedic Dysbarism

LTC Nicholas E. Barreca, M.D.

Provided by the Society of U. S. Army Flight Surgeons

AT FIRST GLANCE one might be inclined to think this will be a discussion about an emotion choked courtroom drama or perhaps barroom brawling. Once again, however, medical linguistics are responsible for the mind lurching gaggle of alphabetic perplexity. What then is this *dysbarism?* By definition, it is *the manifested effects of changing barometric pressure upon the human body* (providing hypoxia is excluded). This term encompasses a large spectrum of environmental stresses and potentially harmful, often painful conditions that may be experienced when one engages the skies or seas.

For clarity, dysbarism may be divided into two types . . . that due to trapped gases and that due to evolved gases (see figure 1). The trapped gas dysbarisms are familiar to all of us and include *ear blocks, sinus blocks, dental pain* and *belly pain.* The evolved gas dysbarisms are less familiar, often being referred to as decompression sickness, and include the *bends, chokes, creeps* and *crumps.*

In this first in a series of three articles, the trapped gas dysbarisms will be discussed. The second article will concentrate on the evolved gas dysbarisms. A final article will relate some recent Army experience with this less common type of dysbarism.

In order to get the right perspective on trapped gas dysbarism, let's place ourselves in the flying environment for a moment. A young, healthy, fit aviator friend of ours is returning from an observation mission in an OH-6A. He is flying to a refueling and staging area at 4,000 feet to keep out of the range of small arms fire, knowing the enemy has no heavy stuff in the area. Upon arrival he begins a steep and fast spiraling descent to avoid any local enemy interference. At around 50 feet he notices fullness and pain in his left ear. As he levels off, attempting to clear his ears, he feels a spinning sensation and settles to a landing before losing control of the aircraft.

What could have happened to this aviator in less than 4,000 feet of altitude? Army air crewmen don't have to worry about pressure changes; they fly low and slow, right? Or do they?

Let's take a look then at the changes in pressure involved. Boyle's Law states that the volume of a *dry* gas is inversely proportional to the pressure providing temperature remains constant. Thus, as the barometric pressure decreases (increases), the volume of a given amount of gas will increase (decrease). A given parcel of dry air at ground level will then expand as it ascends in altitude due to the decrease in pressure so that at about 18,000 feet it could occupy twice its original volume (see figure 2). In the above

situation our pilot experienced a pressure differential on descent of about 100 mmHg. Since his body tissues were saturated with water vapor at constant temperature, the gas expansion was even greater than for a dry gas. As will be discussed below, this change in pressure is more than sufficient to produce problems from the trapped gas dysbarisms. These problems, collectively known as *barotrauma,* are caused by the expansion and contraction of gases in accordance with Boyle's Law, and result in signs and symptoms in the ears, sinuses, teeth and gastrointestinal tract. Your flight surgeon has perhaps bedazzled you with fancier names for the barotraumas (trapped gas dysbarisms) such as barotitis or aerotitis media for middle ear block, barosinusitis or aerosinusitis for sinus block, barodontalgia or aerodontalgia for dental pain and finally abdominal distension or gas expansion for belly pain. Don't let these terms fool you though. They all refer to the same conditions. (Flight surgeons need to keep their nimble minds alert, so they have established certain word games.) With a little bit of effort one can break the code and become quite knowledgeable about the trapped gas dysbarisms. Let's take them one at a time.

Ear block: The barotrauma known as barotitis or aerotitis media is caused by failure to equalize pressures in the limited and confined space of the middle ear when it is subjected to changes in altitude. The middle ears serve primarily as mechanical amplifiers for our hearing mechanism.

• *Anatomy*—Look at the structure of the human ear (see figure 3A). The confined air space of the middle ear behind the eardrum opens to outside air only through the *Eustachian* tube. This tube enables the air of the middle ear to exchange with outside air at the back of the nose near the throat (flight surgeons call this area the nasopharynx). When the pressure between the outside and the middle ear is equalized, the Eustachian tube stays closed. This is because part of the Eustachian tube acts like a flapper valve. The first third of its length is located in bone, thus it is always open. The remaining two-thirds is located in soft body tissues and is lined with cartilage (like that stiff stuff in the tip of your nose). Thus, it is normally closed *unless* the pressure in the middle ear is relatively greater than outside or muscles in the nasopharynx pull the end of the tube down and apart.

• *Normal flying*—As one goes up in altitude, the barometric pressure decreases, and the air inside the middle ear tends to increase in volume. Thus, the pressure in the middle ear begins to increase and tends to bulge out the eardrum before the Eustachian tube is forced open. At about 500 feet or a differential pressure of 15 mmHg the Eustachian tube opens, air escapes the middle ear and the pressure is about equalized. As one continues to ascend the Eustachian tube continues to flap open and closed about every 425 feet to maintain pressure equalization. (This is providing you do nothing active to assist equalization and have no colds or ear abnormalities.) On descent potential trouble starts (see figure 3B). The pressure of the air inside the ear is decreased relative to the outside. Thus, the eardrum is drawn into (becomes retracted) the middle ear. In order to equalize the pressure the Eustachian tube must be opened actively and outside air flows or is forced into it. If for some reason the tube won't open, then the middle ear becomes blocked and pain starts.

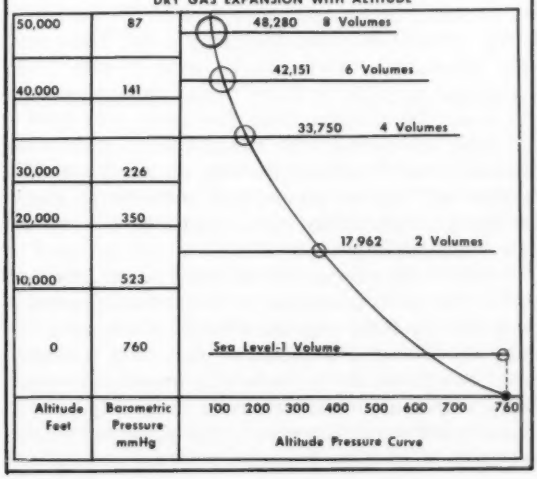
• *Relief*—On ascent no special relief is usually required. On descent, however, your active participation *is* required. When the Eustachian tube becomes blocked pain will develop when a 50 mmHg differential of pressure exists across the eardrum. Prior to

Figure 1

DYSBARISM	
Trapped Gas	Evolved Gas
● Ear Block aerotitis, barotitis	● Bends
● Sinus Block aerosinusitis, barosinusitis	● Chokes
● Dental Pain aerodontalgia, barodontalgia	● Creeps
● Belly Pain abdominal gas expansion or distension	● Crumps

Figure 2

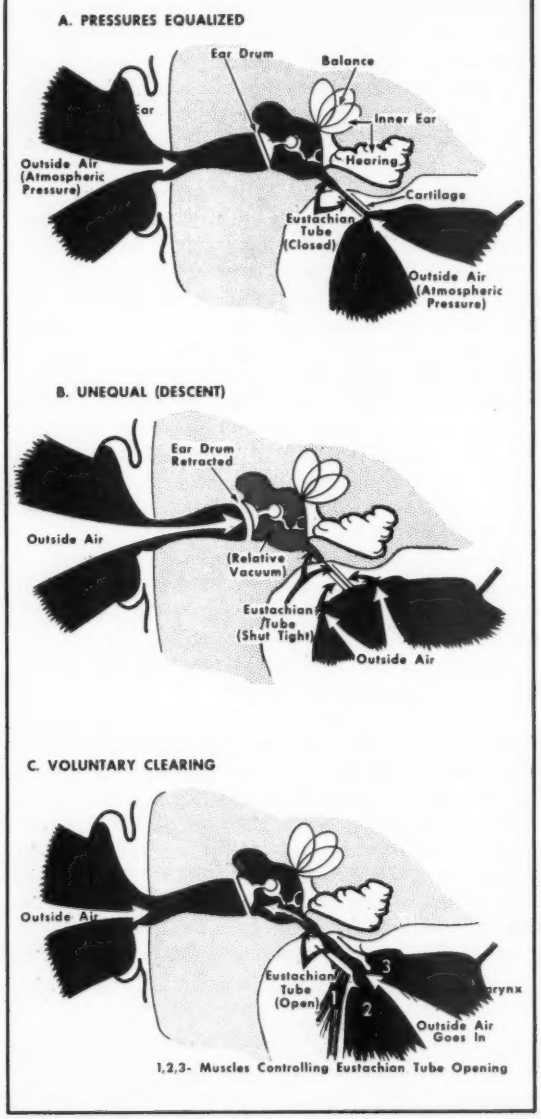
DRY GAS EXPANSION WITH ALTITUDE



this there is a sensation of fullness in the ear. If the block persists and you continue to descend, the pressure differential will increase. At 80 to 90 mmHg difference the Eustachian tube is shut so forcefully by outside air pressure that no manner of voluntary action on your part will open it. Relief will come only by ascent to a higher altitude. Before reaching the point of a "locked" ear block, you can equalize the pressure and relieve the pain by a number of maneuvers. Early this can be accomplished by swallowing, yawning and jutting the jaws out or sideways. This activates three muscles (see figure 3C) in the nasopharynx which pull the opening of the Eustachian tube down and apart. (One can practice the use of the muscles for they tighten the throat and the soft palate—try just moving these!) Another procedure for clearing the ears is by using the *Valsalva maneuver*. This maneuver is performed by every air crewman when he takes a flight physical. The flight surgeon says, "Pop your ears" or "Do a Valsalva" while he looks at the eardrum through an otoscope (ear scope). The air crewman pinches his nose, closes his mouth tightly and forces air from his lungs into the closed space of the nasopharynx. This forces air under pressure up into the Eustachian tubes. The same maneuver can be used in flight to clear an ear block. A similar maneuver (the Frenzel) is a modification of the Valsalva and is frequently used to accomplish the same effect. In this maneuver the epiglottis (valve-like door cover to the lungs which closes when swallowing liquids or solids) is closed, shutting off the lungs; the nose and mouth are the same, but the muscles in the floor of the mouth and throat are used to build up pressure. This also activates the muscles that open the Eustachian tube. The combination of these maneuvers will relieve even a painful ear block. If an ear block is not relieved and the pressure differential goes beyond 90 to 100 mmHg perforation of the drum may occur. There are other maneuvers which can be used to clear ear blocks that are good to know when carrying passengers, especially children. Gum chewing or soda drinking tends to activate the muscles that affect the Eustachian tube opening. Blowing up a balloon will simulate the Valsalva maneuver to some extent. Anyone flying commercially with youngsters will appreciate these methods.

• *Pain*—After a painful ear block occurs, regardless of how mild or whether or not it has apparently resolved, the flight surgeon should be consulted. A mild ear block, if it produces pain, will probably result in redness of the eardrum. A more serious ear block, especially if incompletely or not promptly cleared, will result in redness and retraction of the eardrum. In addition fluid and/or blood may collect in the middle ear. This will normally be associated with noticeable but usually temporary hearing loss. Finally, the most severe type of ear block may result in rupture of the eardrum. Ear blocks are a common cause of noneffectiveness (DNIF) among air crewmen being the most common medically attended trapped gas dysbarism. They are especially prone to happen to individuals who are nursing along a professionally untreated, mild to moderate common cold.

Figure 3



However, not uncommonly (especially among the inexperienced) ear blocks simply occur as a result of failure to periodically and effectively clear the middle ears. Occasionally, when ear blocks become recurrent and troublesome, there may be an underlying cause such as allergy, excessive tonsillar tissue or tumors. The word of advice? . . . see your flight surgeon.

• *Prevention*—The key to prevention is the knowledge of what causes ear blocks and how they are cleared. Remember, there is at least a 100 mmHg differential of pressure between 4,000 feet and sea level. Between 2,000 feet and sea level the differential pressure is at least 50 mmHg, sufficient to produce pain if the ears are not cleared periodically during descent. Certainly then, there is ample opportunity for even the "low and slow" flying Army air crewman to experience trouble. Recall our friendly pilot at the beginning of this article? He apparently failed to adequately clear his ears during descent as a result of channelized attention. It resulted in an ear block and an infrequent complication to be discussed below. Generally, prevention is in your hands. First, remember to clear your ears frequently and systematically during descent. During ascent your ears will normally take care of themselves. Practice the simplest, most effective clearing method you can accomplish.

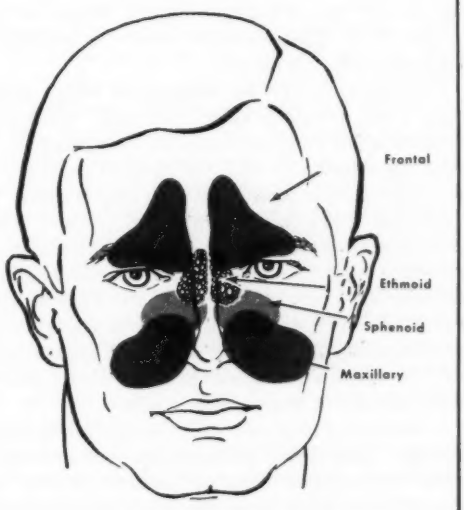
If the Valsalva maneuver is used it should not be too forceful or prolonged. An excessively forceful Valsalva can produce dizziness. A prolonged one can produce lightheadedness or fainting. So the maneuver should be discretely defined and short. When simple maneuvers do not clear the block or it appears that a prolonged or forceful Valsalva might be indicated, then it is time to ascend. Go to a higher altitude until the ear block is relieved, then descend slowly being careful to stay ahead of your ears with equalizing maneuvers.

Second, do not fly with a common cold (no matter how mild) or the active stage of an allergic condition without aeromedical supervision. For the slightly sniffled it is easy to be lulled into complacency when little or no difficulty is experienced on ascent. Remember though, it's on descent that serious trouble is likely to start. Finally, seek your flight surgeon's advice early when an ear block occurs. Do not use any home remedies. Ear drops have little place in the treatment of ear blocks. Never stick anything more than a finger tip in your ear. Not even a cotton-tip applicator, especially not a bobby pin. If you suspect impacted wax as a culprit, then discuss it with your flight surgeon.

• *Treatment*—Sometimes, with a mild cold unaccompanied by the "blahs," your flight surgeon may permit you to fly with certain decongestant inhalers, drops, sprays or pills, which do not preclude safe flying when they are taken under aeromedical supervision. This not only reduces noneffectiveness from DNIF but ensures prevention. However, if the flight surgeon feels you must be restricted, don't balk. He usually must use drugs that are incompatible with safe flying. Further he may be trying to keep you from complications [such as an infected middle ear ("otitis media") or perforation of the drum]. These conditions can result in even greater noneffectiveness and prolonged medical restriction, even suspension.

• *Associated phenomena*—There is a condition known as alternobaric or pressure vertigo that is sometimes associated with sudden and large pressure changes in the middle ear during ascent or descent. The vertigo is due to the fact that the semicircular canals of the inner ear (see figure 3A, "Balance") lie in close proximity to the middle ear. This phenomena can lead to catastrophic consequences.

Figure 4
PAIRED AIR SINUSES



Again, recall the pilot above who experienced a spinning sensation as he pulled out at 50 feet. This may have been pressure vertigo. Another condition of which we should be mindful is the 100 percent oxygen absorption type of ear block (known as "secondary" or "delayed" aerotitis/barotitis media). This occurs frequently after an aircraft or altitude chamber flight requiring the use of oxygen. During the

course of the flight 100 percent oxygen diffuses into the middle ear during clearing. Upon return to ground level, any residual oxygen is absorbed into the circulation of the middle ear. Since little or no nitrogen is available, it is as if one descended in altitude. The pressure in the middle ear drops, the eardrum retracts and fluid begins to accumulate. If an individual goes to sleep or is inactive after a flight, this is more likely to occur. He then awakens with slight hearing loss and "bubbles" in his ears. Usually this clears rapidly, but sometimes requires a flight surgeon's assistance. It can often be avoided if the individual clears his ears actively and remains physically active for several hours after the flight. The use of a diluted oxygen setting (normal oxygen) or mask removal below 10,000 feet will also decrease the likelihood that oxygen will remain in the middle ear.

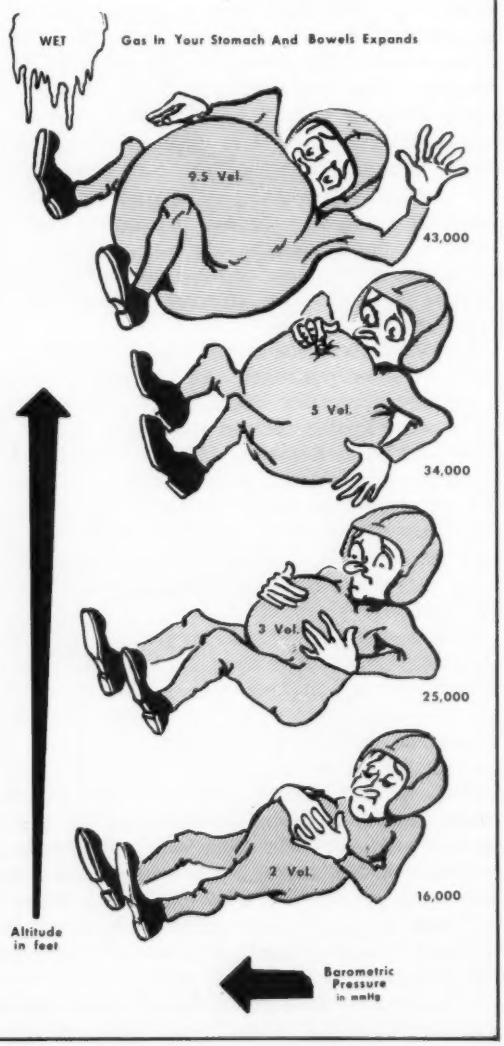
Sinus block: The barotrauma known as barosinusitis or aerosinusitis is caused by failure to equalize pressure in any one of the four paired, boney air sinuses in the skull. These sinuses serve to humidify and warm air as it is breathed.

• *Anatomy*—The air sinuses, of which there are eight (four on each side), are rigid walled spaces encased in the bones of the skull (see figure 4). Each sinus communicates with the internal passages of the nose by way of a small opening (your friendly "fright scourgeon" calls this an ostium or orifice). Through these openings the sinuses equalize their internal air pressures with the outside. The openings are short (except the ones leading from the frontal sinuses) and rigid. Thus, the size of these passageways cannot be voluntarily affected (as with the Eustachian tube). All the sinuses are lined by soft tissues similar to those which line the nasal passages.

• *Normal flying*—As one ascends or descends in altitude, barometric pressure changes are equalized when air escapes from or returns to the sinuses through the sinus openings. No special efforts are normally required on the part of an air crewman to affect this equalization of pressures.

• *Pain*—The first definite sign of a sinus block is sudden pain. This may or may not be preceded by discomfort or pressure over the involved sinus. Thankfully, noneffectiveness due to sinus blocks is not as common as from ear blocks (7 to 8 times more common). Sinus blocks often occur in individuals with some predisposing condition; e.g., an upper respiratory infection, common cold, acute allergy or hay fever, nasal septal deviations or tumors. Pain occurs most commonly on descent. It results when the sinus opening becomes obstructed from the outside in by tissue or swelling. Outside pressure is then transmitted to the sinus cavity through the soft tissues creating a relative vacuum. The lining of the sinus becomes red and swollen and the cavity starts to fill with fluid. Sometimes a blood blister or hematoma forms under the lining. A sinus block can sometimes occur on ascent. This happens if the sinus opening becomes blocked from the inside out by tissue obstruction of some kind. The most common sinus to block is one of the frontal sinuses. Pain due to this block would thus be over one of the eyes. Sometimes this skin over the sinus becomes reddened. The next most common is one of the maxillary sinuses. Pain from

Figure 5



this block would normally be below the eyes, but may travel above or in the eye or to the upper teeth. The ethmoid and sphenoid sinuses are less commonly involved. Pain from these blocks would normally be at the bridge of the nose or over the scalp.

• *Prevention*—Most important, don't fly with a cold or upper respiratory infection especially not with a history of allergy. If a sinus block occurs, as soon as safely possible ascend to an altitude at which the pain is relieved. Level off for a few minutes and use a nasal inhaler or spray if available. Then descend slowly. Upon return to ground level see the flight surgeon as soon as possible. If a block occurs on ascent then reverse the procedure but do not continue with the flight. Return to ground level and see the flight surgeon.

• *Treatment*—The treatment for sinus blocks requires a period of medical restriction from flying duty. It is extremely important to follow the flight surgeon's advice and treatment to the letter. Even after return to flying duty, an air crewman should be alert to the recurrence of symptoms such as discomfort, pressure or drainage. Sometimes a sinus hematoma is not easily detected when a block first occurs. Recurrent symptoms may indicate its presence, so bring them to the flight surgeon's attention as soon as possible rather than risk further complications and lengthy medical restriction from flying duty.

Dental pain: This may be associated with changes in barometric pressure on occasion. If such pain truly arises from a dental abnormality it is known as barodontalgia or aerodontalgia. The condition was once thought to be the result of air pockets under fillings and thus was truly considered a barotrauma due to the expansion or contraction of trapped gas. However, this view is no longer considered valid. In all likelihood the condition results from large deep-seated fillings which are unlined and various degrees of inflammation or degeneration of the tooth pulp. The latter is probably the more common and represents an early stage in a condition which would ultimately cause toothache at ground level. The resultant pain felt in the teeth or jaws is seldom incapacitating.

• *Prevention*—Good dental hygiene is essential, but more important is preventive dental treatment. This requires periodic dental cleaning to avoid gum disease as well as early treatment of dental decay.

• *Treatment*—Note the effect of altitude change on the intensity of pain. The pain can occur on ascent or descent, thus reversal of altitude should result in relief. Upon return to ground level report directly to the flight surgeon. Not infrequently, dental pain may be referred from a sinus block. This must be ruled out by the flight surgeon before referral to the dentist.

Belly pain: This form of barotrauma, known as abdominal gas expansion or abdominal distension, frequently results in discomfort on flights above 10,000 feet. Most individuals normally have from $\frac{1}{10}$ to $\frac{1}{2}$ of 1 liter of gas in the gastrointestinal tract. Most of this gas is swallowed air but some results from the decomposition of foodstuffs and other sources. As one ascends in altitude this gas expands and can exert painful pressure against body organs (see figure 5). The pain usually begins at about 15,000 feet, but at and above 30,000 feet it can become severe and incapacitating. The distension at these altitudes can be great enough to interfere with respiration. This not infrequently occurs in altitude chamber operations from excessive air swallowing while breathing on oxygen systems, or due to dietary indiscretion or self-imposed social constraints.

• *Prevention*—In most circumstances an effective measure is control and selection of dietary intake. Foods likely to produce gas or intestinal irritation should be avoided, particularly those which have proven to be troublesome in the past. Common culprits are unripened fruit, cabbage, sauerkraut, cauliflower, beans, peas, cucumbers, brussel sprouts, high roughage foods (celery, etc.), spices and carbonated beverages. Hurried bolting of meals and gulping of liquids also predisposes to air swallowing as does gum chewing. These conditions should be avoided when higher altitude flights are anticipated. Once in flight frequent belching, passing of flatus and loosening of clothing will prevent discomfort. Some individuals, being overly conscious of social amenities, restrain these normal reflexes, but are soon regretful. Familiarity with oxygen equipment and its use, as well as experience with clearing of ears under these conditions, will decrease the extent of air swallowing. This is another good reason for altitude chamber indoctrination of air crews.

• *Treatment*—Usually preventive measures are all that are required. In some individuals a chronic problem exists due to excessive gas production or air swallowing. These individuals are sometimes relieved with the use of a defoaming agent called simethicone. Tablets of this drug can be chewed and swallowed without side effects. It sometimes permits gas to be more easily dealt with by normal reflexes.

Changing barometric pressure, particularly if rapid, can cause discomfort and pain from the trapped gas dysbarisms. Knowledge of the mechanisms of their occurrence is the best form of prevention. It permits the air crewman to cope effectively with relatively minor stresses which could interfere with mission completion and efficiency. Further, it reduces the likelihood that unnecessary flying non-effectiveness will result from prolonged medical restriction from flying duty.

A Visit To Valhalla

The Valkyries began their escort missions for the guests of this first symposium ever at Valhalla. The meeting is a seminar affair between the air people of the world and the permanent tenants—those who have passed into Valhalla. The most often heard remark from the tenants was, "I wish I had that last decision back"

James H. Devlin, DAC
Flight Instructor

MOST OF TODAY'S well-informed people know that Valhalla is the great hall where Odin receives and feasts the souls of heroes slain in battle. What most people don't know is that there is a special room of the great hall reserved for that special kind of people who have danced the skies on silvered wings and trod the high untrespassed sanctity of space. The title over the door of that special room is simply labeled "Airman of the Universe."

There is great excitement in the air as chairman Leonardo da Vinci and his various committees prepare for the first symposium of its kind ever to be held. The meeting is a seminar affair between the air people of the world and those who have passed beyond the gates of Valhalla . . . permanently.

With battles being plentiful today and aviation accidents far more than necessary, the seminar is an "invitation only" affair since the Valkyries (maidens of Odin who conduct the souls of heroes slain in battle to Valhalla) are cut pretty short in doing their assigned tasks. The thing that brought the need of such a meeting was the fact that things were getting pretty crowded in the Airman of the Universe room and the tenants thereof figured the overcrowding was unnecessary, as many of them now well knew.

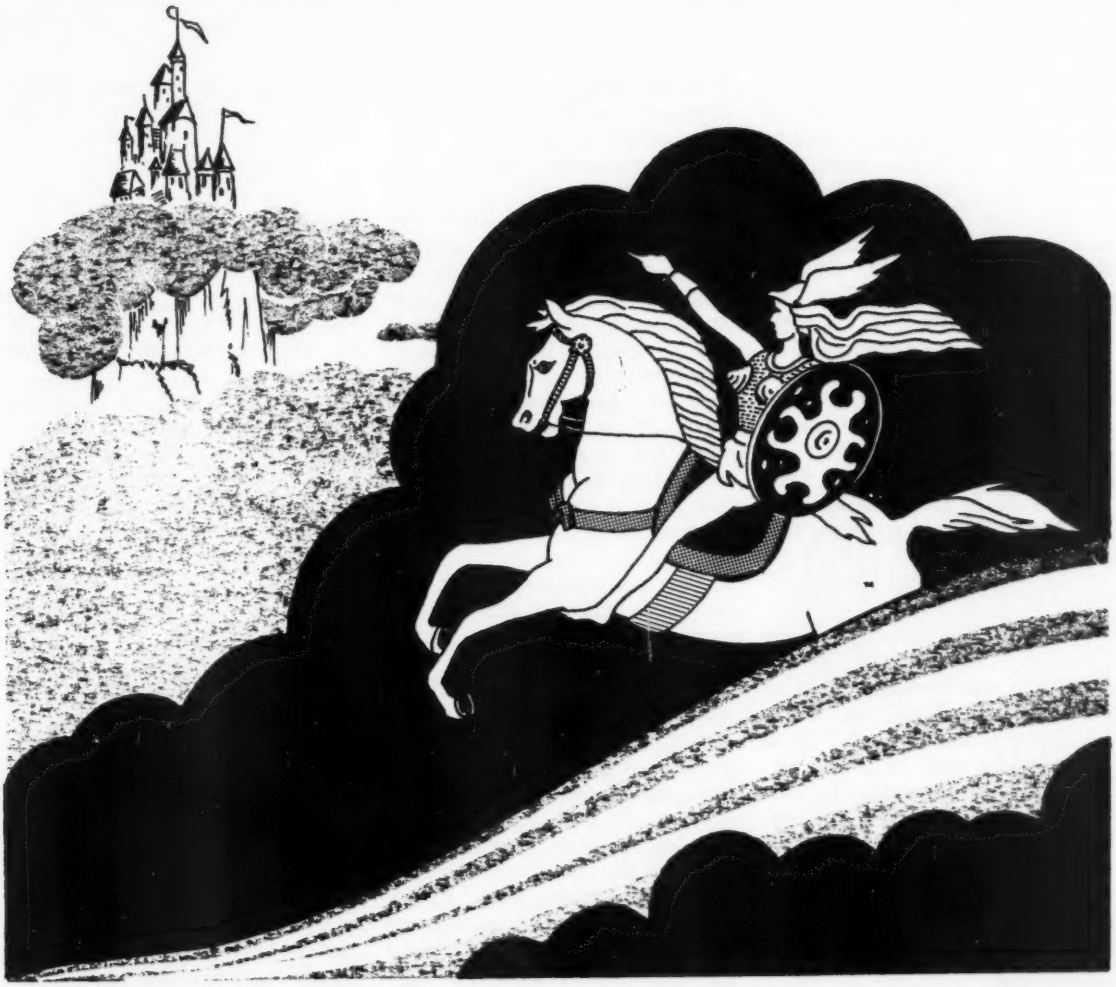
While working on the agenda of subjects to be covered during the meeting, the most often repeated phrase heard was, "I wish I had that last decision back," whereupon Odin advised them all of their status in Valhalla and, furthermore, *that status* was irrevocable and permanent. With the retrospections out of the way the committee members returned to the preparations for the soon-to-take-place meeting.

The guest list included directors of safety of all interested aviation agencies and special gold-plated invitations to directors of aviation accident prevention research agencies. The gold-plated invitations were intended as an inducement to bring along the accident reports to the meeting without invoking the privileged nature of the reports. After all, this meeting was set up to prevent accidents, wasn't it? The RSVPs from those "keepers of the records" allayed any fears in that respect. To a man the RSVPs included the statement, "That's what our business is all about—prevention."

With the great day of the meeting at hand, the Valkyries started their escort missions to Valhalla. The first day of the meeting was scheduled as an informal get together and a "renew old friendships" type of affair. Since there was no cocktail bar set up (not permitted by local regulation), the activity consisted mainly of conversation and hors d'oeuvres (which by mortal standards weren't too palatable).

The following day the meeting started promptly at infinity minus X (which is how time is measured in Valhalla). With all of the accident reports laid upon the table for any air accident that ever occurred, it would be extremely helpful in obtaining the before and after picture of the entire accident. What is more important, it would permit instant replay of the cause factors leading up to the decision that the accident experts wish they had back.

Pistol Pete (who gained that nickname for his tendency to go off half cocked) was an ex-airline captain, age 40 plus infinity. He



started off the seminar by recounting the hours of mortal time leading up to the fateful decision he wished he had back. To begin with he had a misunderstanding with his wife before departing for the airport. Upon arrival at operations he was assigned a substitute first officer with whom he had never before flown. Next came the weather, which was WOXOF at departure point and destination, causing a delay.

The forecaster's prognostication called for slight improvement within the next couple of hours. It appeared that it was just one of those days, as the aircraft did not check out on preflight causing the need for a replacement aircraft. With the replacement aircraft obtained and checked, the stewardesses commenced loading a bunch of grumpy passengers. A few even had some unkind remarks for the captain when he boarded.

As they approached the destination at 0600Z and called for approach clearance, air traffic control (ATC) advised them to hold with an expect approach clearance at 0700Z. The terminal weather wasn't all that good either, hovering right around minimums.

After many trips around the racetrack, which did nothing to improve Pete's disposition, they were finally cleared for an ILS approach. On the final Pete had trouble keeping the glideslope needle centered. Was it equipment malfunction or overreaction on controls and power? The aircraft crashed just outside the middle marker; there were no survivors.

The findings of the board were that engines were developing full thrust, no indications of control malfunctions and that ILS equipment—both transmitter and receiver—were functioning properly. The records of the captain indicated that he was a good pilot and repeatedly passed the various Federal Aviation Administration and company flight checks with flying colors. As the captain was granted the floor and spoke, his statements probably revealed more than the myriad statements and

exhibits contained in the official accident report. He stated that on that fateful day "things seemed to irritate or bother me more than usual" and "I just didn't seem to be my good old jolly but professional self." The Valhalla resident psychiatrist/flight surgeon concluded with the medical fact that no human being is the same physical, mental or psychological individual from day-to-day, week-to-week or for that matter from hour-to-hour as he might think he is. Most individuals adjust or compensate for these minor deviations from the norm either consciously or subconsciously. On that fateful day Captain Pistol Pete did not successfully adjust or compensate.

Next on the agenda was the report of a crash on takeoff in the venerable and extremely reliable old "Gooney Bird" or C-47. Lieutenant Colonel "Snuffy" Smith (who gained that nickname because he was attempting to kick the cigarette habit with the occasional use of snuff) was the aircraft commander. There was quite a delay as crewmember substitutions were made necessary by nonavailability of the originally scheduled crew. It must be noted at this point that all substitute crewmembers were considered highly qualified in their respective positions on the basis of past performance, hour level and checkride performance reports.

Once the crew was finally assembled, the tragedy starts to unfold. With a "kick the tire and light the fire" type preflight (not exactly professional or consistent with regulations or directives on use of established checklist for the type aircraft being flown), the crew entered its last mortal door. The next one would be the door on the "Airmen of the Universe" room in Valhalla.

Now in the instance of the checklist for the C-47/DC-3, it gives the aircraft commander three chances at par for the course since the checklist states during walk-around inspection "remove gust locks," before entry to aircraft "count number of gust locks" and prior to taking active runway "move all controls through full range." The question might arise among the "Monday morning quarterbacks" as to why one of three required checks did not uncover the eventual culprit. The fact is that these human individuals reverted to a very human trait of succumbing to expediency in that they gave in to one of those two insidious cliches of fliers "get-off-itis" and "get-home-itis."

After "cleared for takeoff" the remainder of the accident report is merely trivial since the moment of impact was already determined as a direct mathematical/time function of how fast the aircraft commander applied takeoff power. The question comes up at this point from one of the more recent inductees into Valhalla: "Due to a rash of landings a phrase was added to the Air Traffic Controller's Manual to the effect, 'Check gear down and locked,' so why not another amendment to the manual to include, 'Check controls through full movement or check gust locks removed,' and after an affirmative answer reply, 'Cleared for takeoff'?"

Chairman Leonardo da Vinci opined that although he personally did not have much experience with air traffic controllers since with all his paintings, aviation envisionments, mathematics, etc., he just hadn't gotten around to radio yet, that it just made good sense that if just one 5¢ radio transmission could save many thousands or millions of dollars and untold human suffering, it would be far better odds than anyone could get in Las Vegas or Reno. Now, anyone knows that Leonardo had no conception of Las Vegas or Reno, but he did have that rare forward vision that could interpret the full results of his present actions.

"We sure could use more of that capability in our day-to-day flight operations," stated CINCUFO (Commander-in-Chief, Universal Flight Operations). The lesson to be learned in this accident is not vision other than 20/20 in order to be able to read and heed the *checklist.*

In the next case we encounter a well-qualified civilian with commercial SMELS plus type ratings CFIAI including rotorcraft. Let us call him Joe Btsfle who, like the Al Capp character of Li'l Abner fame, carries the proverbial "cloud of doom" with him wherever he goes. This individual has "every rating in the book" except glider, dirigible and balloon and that's because he has this personal thing that if he can't hear it purr or whoosh "I don't want to fly it."

So be it, and as one literary giant once stated, "To each his own." Back to the situation at hand, this individual was flying on a VFR business trip and according to ATC reports had reported flying as high as 25,000 feet in order to stay out of clouds before requesting clearance back to his point of departure. After clearance back to his point of departure, the accident report noted that the airplane disintegrated in an uncontrolled dive to the ground with all persons aboard becoming permanent residents of Valhalla.

The accident report indicated that the pilot was considered well qualified, consistent with his hour level, ratings and checkride results. The last known or recorded servicing of the supplemental oxygen system aboard the aircraft had been indicated as several months prior to the accident date. Subsequent to the servicing date an undetermined amount of oxygen had been consumed by a passenger without proper notations being

made in the aircraft logs, as a result the system was not reserviced.

Additional investigation revealed that the oxygen system was capable (at full service) of delivering 2 hours and 50 minutes at 25,000 feet (more at lesser altitudes). However, the fatal flight "point of no return" had been 2 hours and 53 minutes. In the investigation of the wreckage it was determined that the oxygen system regulator valve was in the full open position but, forsooth, the pressure gauge registered zero.

At this point it must be pointed out loud and clear that at 25,000 feet a pilot has as little as 2, duo, minutes during which he will be physically and mentally capable of recognizing and acting to avert the disastrous results of hypoxia which is no "paper tiger" but a real and imminent danger "to successful completion of the flight."

To the correction of the problem of oxygen deficiency in flight, Leonardo gave the opinion (based on his dabbling in medicine) that he understands that hypoxia is a condition in which the brain and body tissues lack sufficient oxygen to permit proper functioning. The higher you go, the more supplemental oxygen you need. At approximately 28,000 feet you will need 100 percent oxygen. Recognition of this problem becomes difficult because of the nature of the symptoms.

One of the first indications of oxygen deficiency is a feeling of exhileration and well being often associated with consumption of the "nectar of the gods."

"No wonder the symptoms are the same," cried out one of the symposium conferees, "since alcohol burns up oxygen in the system."

Now, it is true that oxygen deficiency varies from person to person or in the same person it varies in intensity or degree dependent on that individual's physical condition at any particular time. In addition to the aforementioned feeling of exhileration the symptoms can include any or all of the following symptoms including increased breathing rate, headache, fatigue, dizziness, listlessness, tingling sensation in the extremities, sweating, poor coordination, *impairment of judgment,* reduced visual acuity, sleepiness, cyanosis (blue color of skin, fingernails and lips) and *behavior changes.*

In retrospect, this accident could have been prevented according to Leonardo (who had a hobby of meteorology and deficiency of oxygen in the human organism) if the pilot had: (1) followed good flight safety principles and checked the oxygen supply, (2) recognized oxygen deficiency symptoms and (3) since he was instrument qualified, requested assignment of lower altitude even if it meant continuation of the flight IFR. That would have been much better than PCS to Valhalla and it is, in this type situation, *a permanent change of station.*

Next on the agenda is the case of the pilot out of fuel and out of luck. The accident started developing long before it happened. His experience included over 5,000 hours with commercial license CFIME and instrument rating. His assignment on this final flight was hauling class A explosives on a government contract. Because of the nature of the cargo and the possibility of future government contracts, the nonscheduled air carrier operator selected their most qualified pilot for this flight. The first *faux pas* this pilot made was not refueling at the cargo pickup point since the weather was not prognosticated to be all that good at final destination.

Of course, the cliche about burning fuel to carry fuel comes into full focus because the fuel left in the storage tanks at point of departure "ain't worth a tinker's dam" on final approach with fuel gauges reading *empty.*

Back to the realities of life, when approach control at destination reported in a barely distinguishable voice: "WX indefinite ceiling 1,300 feet, obscured, visibility ½ mile with snow." The pilot requested radar vector to final approach course ILS. Immediately thereafter pilot requested "course turn on" (an expedited turn to the outer marker) probably after noting fuel tank indicators flirting with empty.

In this comedy of errors the next report was "missed approach" with a more excited request for "course turn on." At 2 miles from the outer marker, he reported he had just feathered the left engine and requested that emergency equipment stand by. At 5 minutes *after* fuel exhaustion time listed on the flight plan, he reported that the other engine had quit. It might be added that it did not surprise approach control or tower that seconds later the aircraft disappeared from the radar scope (a radar monitored approach).

Rescuers found the aircraft and the fatally injured pilot ¾ mile from touchdown point on course but definitely below glide slope. Investigation revealed that less than 1 gallon of fuel remained in the aircraft even with squeezing auxiliary and main tanks. There was no malfunction indicated other than the nut between the control column and the throttle.

Leonardo shook his head in sad dismay. "So unnecessary," he was heard to remark. The findings as to the probable causes of the accident were fuel exhaustion due to pilot's inadequate flight planning and preparation, coupled with improper inflight decisions. The pilot, now in residence at Valhalla, allowed that the findings were 100 percent correct and justified, but in mitigation he submitted that he just didn't seem to be his usual reliable self on that day and that it just seemed to be one of those days that everyone has once in a while when nothing seems to go right. "Not much mitigation in view of the results," he stated, "since nothing can change my status. However, it may prevent similar incidents happening to those people down there."

Since the conference had consumed several days of earth time, it was suggested that the conferees sum things up, arrive at conclusions, and possibly come up with some new approach to preventing future accidents. It was noted that there were several similarities in these accidents.

First, it was the notation that all of the pilots were considered well qualified; none had any previous accidents, incidents or flight violations. All were considered professional in the true sense of the word. Each had expressed in some manner that he just didn't seem to be "up to par" on the fateful day and things simply seemed to keep piling up.

At this point Leonardo interjected the opinion (based on another hobby he had—psychiatry) that every individual has his breaking point or point beyond which he is incompetent to make rational decisions or actions. In most accidents the actual impact is post facto with many factors and circumstances merely leading up to impact, whether self-induced, bad inflight decisions or outside factors. It is noted by Leonardo that we don't have a bunch of pilots with suicidal tendencies, therefore, we must presume that at some point in the flight the pilot is put beyond his capabilities. It might serve well for every pilot to adhere to the old adage: *Know thyself.*

Possibly one of the biggest lessons to be learned from the seminar is that accidents are no respectors of age, experience, training or intelligence quotient. Accidents happen to the whole spectrum of people, but they are definitely and positively preventable. The symposium revealed some aids in prevention of accidents: Know your own capabilities and limitations, know your aircraft's capabilities and limitations and faithfully use aircraft checklists. Other suggestions offered: Plan the flight well to include selected options insofar as can be foreseen and then fly the planned flight. Enroute, do not depart from the plan for any reason other than protection of passengers, crew and aircraft, or unless the planned flight is amended by air traffic control. In flying there is an old cliche, "Never get caught without a course of action to take." As a last resort, if you run out of options and just don't know what move to make next, there still remains one option open to you: Swallow your pride, don't panic, get on the radio and request ATC personnel for assistance. They are trained to handle most any kind of inflight situation, and can, in the vast majority of cases, get you on the ground safely.

With these conclusions reached, the meeting was adjourned a little early so that the guests could get ready for the farewell formal dining in.

The following day, after thoroughly planning the return flight to earth, there were a few ATC delays on clearances but no major problems. After Valhalla tower cleared us for frequency change to Valhalla departure control and takeoff, we started the journey home. Our departure call was brisk and confident: "Climbing to interplanetary orbital track, flight level One Zero Zero Zero Zero."

Departure control replied, "Have a safe flight, see you next year at the conference." That courteous comment brought up the question: Would a conference next year be necessary, or would the accident prevention program based upon the experiences of those who have been there cause a significant enough reduction in accidents to make next year's conference unnecessary? Only each and every one of you people who fly the azure blue can answer the question. You hold the key as to whether all the preventable accidents are, in fact, prevented. To quote an old sage, "You are here so short and gone so long."

The New Challenge

Continued from page 3

active Army are going to have to hitch in our belts. This means that many aviation units with prime assets and personnel trained to operate them will be contained in the Reserve Component force structure.

Since reduction of the active Army began, the *One Army* concept has taken on added importance. As I pointed out earlier, the active aviation structure has been cut, so shortfalls must be met by Reserve Components. Figure 3 reflects the Reserve Component aircraft forecast as it is planned for FY 74.

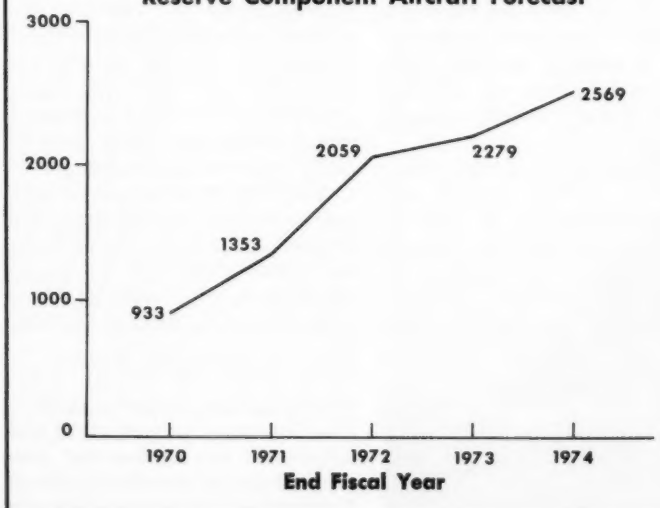
Since 1970 when the Reserve Component aircraft inventory was near 900, most of which were obsolete, more than 1,000 first-line aircraft have been allocated and distributed to the Reserves. There now is in excess of 1,800 aircraft in the hands of the Reserve Components, and by the end of FY 74 they should be at 88 percent of their approximate 2,900 authorized aircraft.

It now appears that by the end of FY 73, 59 percent of the Reserve inventory will be comprised of prime assets such as UH-1, CH-47, CH-54 and OV-1 type aircraft. The bulk of substitute assets will be the UH-1B/C, in lieu of the AH-1G.

Figure 4 (page 16) shows the growth of National Guard and Reserve aviator strength from 1969, when increased emphasis was placed on the One Army aviation concept, to FY 74. As a result of the aviation recruiting program initiated in 1970 more than 1,500 experienced aviators were recruited into Reserve Component units. As more aircraft become available, recruiting experienced personnel may not be sufficient to meet all Reserve Component aviator requirements. Therefore, school quotas for Reserve Components have been increased which, coupled with recruiting of experienced personnel, should meet aviator requirements.

Figure 3

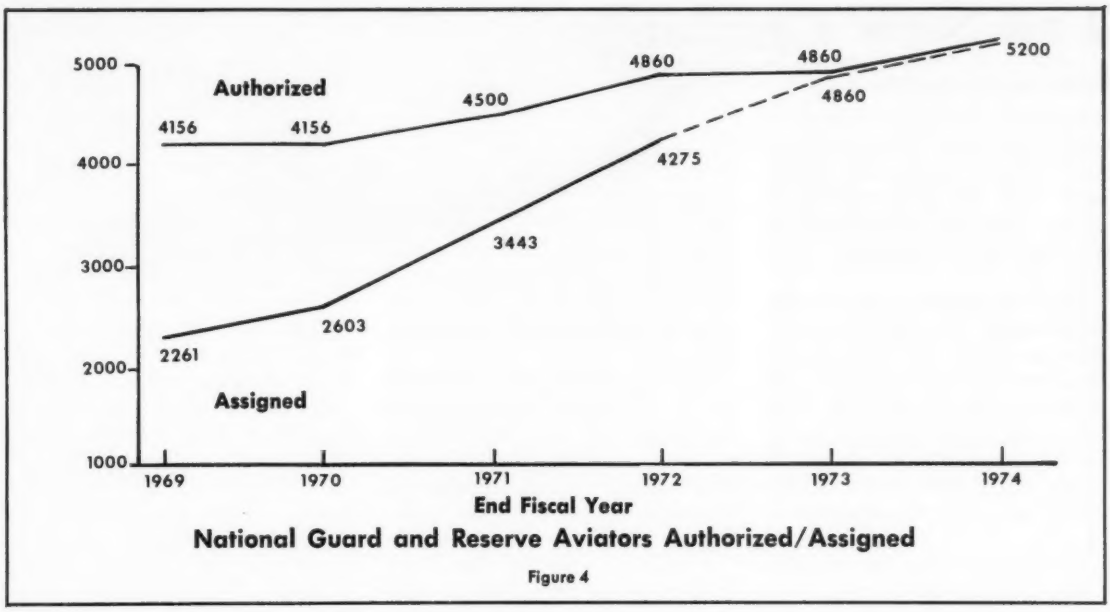
Reserve Component Aircraft Forecast



The increase in active Army and Reserve Component aviation assets outside the combat zone and the shift of training emphasis to a mid-intensity environment has precipitated a number of actions to improve professionalism in Army aviation.

At the Department of the Army's direction, CONARC developed a flight standardization program for Army-wide application. The program, published by DA on 29 June 1972, provides for a hierarchy of standardization boards from DA to installation level to administer the standardization effort. Standard criteria for the selection and training of all instructor pilots is provided as well as a system for semiannual or annual flight evaluation of all aviators on flight status. The program also makes provisions for publication of standardized literature for flight training and operations. The formalization of flight standardization will enhance the maintenance of high standards of individual aviator proficiency and should result in reduced aircraft accident rates.

Last March an instrument quali-



National Guard and Reserve Aviators Authorized/Assigned

Figure 4

fication program was established with an objective that all Army aviators on flying status obtain a standard instrument rating by the end of the calendar year. In spite of numerous obstacles excellent progress has been made toward this goal. Although the deadline this month may not be met at all installations and activities, the many excellent local training programs promise early attainment of our goal during 1973.

Revived emphasis has been placed on nap-of-the-earth flight operations as a means of enhancing aircraft survivability in the mid-intensity combat environment. The U. S. Army Aviation School (USAAVNS) at Ft. Rucker, AL, has revised rotary wing initial entry and rotary wing instructor pilot course POIs to include this training and is preparing training literature on the subject for dissemination to the field in the near future.

Army aviation, to include nap-of-the-earth flying, is meaningful to the extent that it supports ground units in the accomplishment of their missions. Proficiency flying by individual aviators, if not mission oriented, fails to contribute to this objective. Therefore, to make sure that training efforts are productive we must develop unit training programs that ensure realistic, tactically sound training and yet provide adequate control to minimize the risks inherent in low-level flight operations. DA and CONARC recently have published an abundance of policy and guidance aimed at assisting aviation units in the establishment of safe and effective nap-of-the-earth training programs.

Some time ago CONARC recognized that we had aviation unit training programs for all types of aviators except one—the attack helicopter crew. Anticipating an increase in CONARC aviation assets resulting from the drawdown in Vietnam, which was then starting and subsequently accelerated, first Ft. Knox, KY, and then the CONUS Armies were tasked to develop an attack helicopter crew gunnery training course. The result: a viable attack helicopter gunnery crew qualification plan that we implemented within CONARC last August. The plan includes details of firing ranges, ammunition requirements, firing tables and courses of instruction to be completed before arrival at the firing range, and should enable CONARC to meet its attack helicopter crew training objective—to fire, for qualification, each attack helicopter crew in CONARC, the active Army and the Reserve Components by the end of FY 73. Thus, CONARC units with attack helicopters now have a training program that will enable them to attain and maintain readiness.

An Army aviation mutual support program for active Army and Reserve Component aviation units has been established to ensure optimum use of aviation assets and expertise and to promote the conduct of airmobile training for active Army and Reserve Component aviation and ground units. The One Army program as it pertains to Army aviation has thus received an unprecedented boost. Regulations and training guidance

focused solely on the Reserve Components are rapidly falling by the wayside and are being replaced by policies that are applicable to all components.

We also are placing additional emphasis on safety within aviation training by:

• Documentation of the requirement for a safety officer position in each aviation company-sized unit, airfield command and flight detachment TOE/TDA. This documentation will authorize trained safety specialists who can establish and conduct sound unit accident prevention programs.

• Establishing the requirement for commands to requisition school-trained safety officers, commissioned or warrant as appropriate, for assignment to units which do not have a trained individual assigned and do not have quotas to the University of Southern California safety course.

• Emphasizing the use of aviation accident prevention surveys and assistance visits to determine the effectiveness of unit and installation aviation safety programs.

• Establishing guidance, based on accident trends, to reduce aircraft accidents during ferry flights, combat readiness flights and transition training.

In addition, CONARC recently has taken action to establish an aviation command and resource management course at Ft. Rucker. The purpose of this course is to provide potential aviation commanders with a working knowledge of the principles of aviation accident prevention and management with respect to aviation assets. In the development of the program of instruction, USAAVNS is closely coordinating with the U. S. Army Agency for Aviation Safety to ensure that future commanders make effective and efficient use of all safety and accident prevention tools available to them. The annual training requirement for this course is estimated to be 100 commissioned officers and the first class should begin this February.

The One Army concept is a reality! The Reserve Components have made remarkable progress in recruiting experienced personnel, issuing aircraft and establishing training programs. The goal of the Reserve Components is the same as that of the active Army—to provide fully combat ready, instantly deployable aviation units, wherever and whenever needed to preserve the security of the United States.

Army aviators have excellent reasons for facing the future optimistically. We have a wealth of professional experience and a vastly improved aircraft fleet. With these ingredients we can move confidently to meet any challenges the future holds.

Most importantly, we have airminded, airmobile commanders with a generation of combat experience in Vietnam behind them. They will never be satisfied without a *"Three Dimension Army,"* which they will adapt to situations facing them.

Let me remind you and emphasize that in the fifties and early sixties all of the original doctrine and tactics for employment of *organic Army* aviation in achieving *battlefield tactical airmobility* were developed for the minimum of a mid-intensity environment. All of our early tests, to include those of the 11th Air Assault Division (T), validated the soundness of our concepts in this environment. Many people forget that during the tremendous growth in Vietnam Army aviation demonstrated its terrific inherent flexibility by adjusting and modifying tactics to an entirely different environment. Now, we must go back to many of our original practices such as nap-of-the-earth flight, maintenance in dispersed field conditions, camouflage, etc. We must actually unlearn many procedures we used during recent years of combat in Vietnam. The new challenge is for all and I know it will be met in the new era of Army aviation that is upon us.

The drawdown in Vietnam has resulted in the rapid redistribution of modern aircraft assets throughout the Army. Preferred assets including the OH-58 (right) are being assigned to meet most requirements

Maintenance

When Repairing Aircraft Tubes

Repair Of Aircraft Tire Tubes: Hold it! Before you begin repairing that aircraft tire tube, check TM 55-1500-204-25/1, paragraph 3-215, pages 3-63. It contains some valuable information on making that repair. For instance:

All reparable tubes will be repaired by a permanent method. A vulcanized patch is one method. Any tubes found to be patched with a cold patch will be either classified as reparable or condemned, as appropriate.

1. Reparable inner tubes are as follows:

a. Tubes with rubber-covered valve stems that are damaged, have base separation or the valve pulled out.

b. Tubes with a damaged area less than 3 inches.

c. Only natural and butyl rubber tubes will be repaired. Butyl rubber tubes can be identified by a blue stripe on the inner circumference of the tube.

2. The following tube conditions are considered nonreparable:

a. Those that exceed three repairs per tube at less than 30 degree intervals.

(1) In excess of ½ inch by 2 inches for tubes with a cross section width of less than 8 inches.

(2) In excess of ½ inch by 3 inches for tubes with a cross section width of 8 inches or larger.

b. Tubes that require more than one resplice. Fabric based tubes will not be respliced.

c. Tubes with torn or punctured fabric or inner liner separation more than $\frac{1}{32}$ inch.

d. Tubes requiring more than one of the following combinations:

(1) One revalve and one resplice.

(2) One revalve and one repair.

(3) One resplice and one repair.

(4) A and b above exclude fabric based tubes.

e. Tubes with deterioration or thinning due to brake heat. Heat damage may be detected by inspection. This damage may be indicated by extreme tackiness or dryness of the rubber near the wheel rim.

f. Tubes deteriorated by solvents or hardened by age.

g. Tubes with more than two blisters or a blister greater than ⅜ inch in diameter.

h. Tubes with severe surface cracking over $\frac{1}{64}$ inch deep or indication of deterioration.

i. Tubes with valve stems torn or pulled from fabric based tubes.

j. Tubes which have folds or creases.

k. Tubes that are chafed or pinched from beads or tire breaks.

Adjustment Of O-1A Voltage Regulator: Remember to keep the generator switch in the ON position during voltage regulator adjustment. Placing the generator switch in the OFF position will prevent the generator from producing more than residual voltage. This will make the adjustment of the voltage regulator impossible.

UH-1 Main Drive Shaft Problem: The UH-1 series helicopters have encountered many main drive shaft problems causing excessive downtime and unnecessary expensive

Matters...

parts consumption. One particular maintenance malpractice has been observed in several aircraft companies and concerns the following:
1. The main drive shaft (short shaft) attaching clamps employ internal wrenching high tension bolts as indicated in figure 1. Note

Figure 1

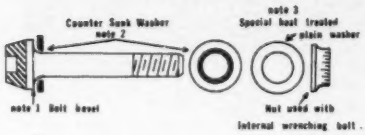
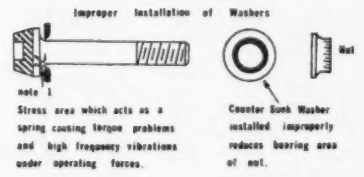


Figure 2


Improper Installation of Washers
Nut
note 1
Stress area which acts as a spring causing torque problems and high frequency vibrations under operating forces.
Counter Sunk Washer installed improperly reduces bearing area of nut.

1 of figure 1 shows the tapered shoulder of the internal wrenching bolt and how it curves to prevent stress from being applied at any given point and distributes the shearing forces. Note 2 of figure 1 illustrates the proper counter sunk heat treated washer for the bolt head side of the internal wrenching bolt. Note 3 of figure 1 illustrates the proper washer for nut.

2. Improper installation of the washers when installing the drive shaft will:

a. Give a false impression of torque to the mechanic causing loose clamps under operating conditions.

b. Act as a spring when under normal operating stress causing a high frequency vibration which causes excessive heat. This heat breaks down lubricants causing damage or destroying the drive shaft in just a few hours of operation.

c. Cause high stress coneentration at one point on the bolt which weakens the bolt and renders it as unserviceable.

3. Figure 2, note 1, illustrates the improper washer stack-up on an internal wrenching bolt and note 1 illustrates how the washer gives a false impression of torque which will fool both the torque wrench and the inexperienced mechanic along with a flexing when under operating stress. These factors will weaken the bolt and make it unserviceable.

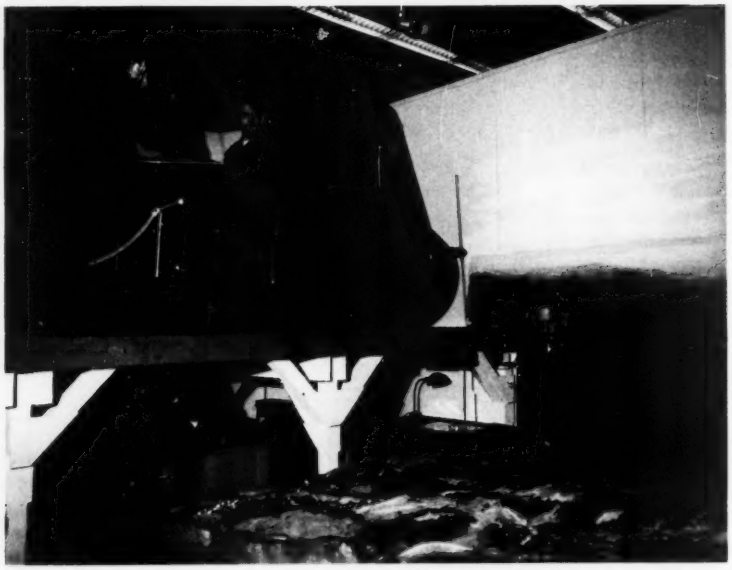
4. It is highly recommended that all maintenance officers, NCOs, technical inspectors and technicians be made aware of this problem, its seriousness and proper management procedures to ensure it does not occur in their units.

5. The proper use of internal wrenching bolts and utilization of special washers can be referenced in TM 55-1500-204-25/1, page 2-3, paragraph 2-25 and figure 2-82. Also see Federal Aviation Agency Aircraft Manual 43.13-1, page 97, paragraph 120h.

UH-1D & H Model Tail Rotor Inspection: When inspecting the tail rotor drive shaft, do not mistake a single empty imprint in the bonding material next to the balance strip as an indication of a missing balance strip. This spot results from a removal of a test coupon to inspect for bonding voids. Reference: TM 55-1520-210-20, chapter 7, section 5, paragraph 7-115.

Tropical Maintenance: Did you know that operational turbine engines should be run up once every other day in the tropics? Reference: TM 55-1500-204-25/1, page 1-12, paragraph 1-42.

FOD Again! When cleaning turbine engines, remove all pencils, cigarettes, etc., from pockets. The Army doesn't need anymore FOD induced mishaps!



an approach to aerial command and control training

Lieutenant John G. Schleicher

THE GROUND commander realizes that in order to take full advantage of today's mobile ground troops, he must effectively exercise *personal* control over them. The employment of an aerial command platform by the battalion commander is fast becoming the vital link in the chain of command from platoon to division and higher.

The commander, after his first command and control mission from the air, will have to admit that it is a different ball game than one that is being commanded from the ground. The rules of the game, the planning, tactics and radio procedures have not changed—and neither have the players. What makes aerial command and control different can be seen when it is compared to a person viewing a football game from the 50 yard line as opposed to sitting at home and only hearing the same broadcast over the radio. The commander may feel safer and more comfortable in his tactical operations center, but history has proven that battles are not won from easy chairs.

Realizing this, the U. S. Army Infantry School at Ft. Benning, GA, set out in 1969 to train commanders and staff officers in the effective utilization of the helicopter as an aerial command and control platform. Besides the training aspects, the Aerial Employment Committee of the Infantry School was tasked with research and development of a total learning environment which would simulate to the maximum extent the stresses and pressures encountered by the commander's staff groups in combat.

The first class was presented in May 1969 to colonels and lieutenant colonels attending the Special Vietnam Orientation Course at Ft. Benning prior to their assuming command of infantry units in the Republic of Vietnam. The class used readily available training aids including motion pictures of the terrain, Vu-Graph transparencies, 35 mm slides and communication via an AN/ASC-15 radio console. In the initial class only one student was exercised at one time. With the addition of terrain model and an elevated platform overlooking the terrain to simulate the aerial helicopter platform, the instruction was expanded to include four students. The present system incorporates into a 50 man classroom four separate simulators and a premission briefing center.

Before coming to class a student receives an advance sheet outlining the general situation for his problem. He then receives a general briefing within the classroom via an automatic 35 mm slide and tape presentation and color video tape. Along with an explanation of the simulator, the student is given information on the operation of the AN/ASC-15 command and control radio console and a premission briefing to include the enemy situation and what resources are available to him for support of his operation. The premission briefing center is capable of projecting two separate pro-

grams simultaneously. Students seated at tables with mapboards and signal operation instructions (SOI) receive the audio portion over individual headsets.

Following the premission briefing the student organizes his plan within his staff group which consists of a battalion commander, operations officer, fire support coordinator and air mission commander. Four such staff groups can be trained simultaneously.

After the members of the group receive coordinating instructions from the primary instructor, they take their places within the simulator. A UH-1 helicopter fuselage elevated above each terrain model gives the student commander and his staff an aerial view of their area of operations. The commander and his staff are provided headsets with which to communicate with ground units, artillery support, liftships, tactical aircraft and higher headquarters. Two quarter-track audio tape recorders provide artillery, gunfire and helicopter engine sounds that may be added to support the realism of the simulator.

Each of the four simulators represents a different terrain environment to include jungle, mountainous, gently rolling and desert battle areas. The detailed 1:3,000 scale terrain models correspond to a 1:50,000 scale military map and represent an area of 9 x 11 kilometers. Produced by Third U. S. Army Training Aids at Ft. Benning, the terrain models are well detailed to give those in the command and control helicopter as much information as they would normally see from their aerial vantage point.

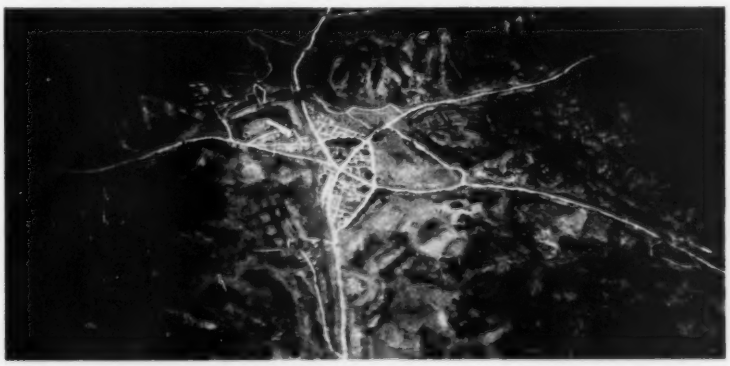
Artillery and gunfire are portrayed by flashing lights located singly and in clusters throughout the terrain model. These lights are controlled by a 60 switch control panel. When a student calls for artillery at a coordinate not represented by a cluster of lights, the principle instructor simulates the puffs of smoke using small pieces of cotton. Colored smoke, used for marking positions, is also simulated using small puffs of cotton in the same colors as issued smoke grenades.

Reports received from students who have gone on to become commanders and staff officers have been most favorable. A recent study developed with the assistance of the Human Resources Research Organization (HumRRO) has shown that although the initial class raised the confidence level of participating students, the present configuration employing the terrain models and helicopter mockup is a significant improvement over previous simulation techniques. Plans for future development call for further study as to the feasibility of more sophisticated means of simulating the tactical environment.

One concept calls for a camera model system in which a television camera is made to move closely over a terrain model. The image projected onto a large screen creates the phenomenon of flight. This type of system—utilizing two cameras at opposite ends of the terrain model—could simulate ground viewpoints and allow two ground commanders to "compete" against each other.

Another concept has been proposed which would utilize computer support to display ground tactical information for the student commander and his staff. The programed computer would add the dimension of analyzing real time movement rates, fuel consumptions and losses of friendly and enemy troops based on the commander's decisions. The latest in computer use in environmental simulation is computer generated imagery. It is receiving widespread use by the aircraft and aerospace industry to train pilots and crewmembers. This device would utilize the computer to generate and display an almost unlimited amount of data to include projecting terrain and superimposing aircraft, vehicles and even weapons fire. The computer could store data such as the characteristics of heavy machine gun fire and the trajectory of artillery fire.

The ability of the Combined Arms Tactical Training Simulator (CATTS) to reproduce situations both on and above the battlefield not only exposes a potential commander and staff officer to the stress and pressures faced in an actual operation, but it also has the potential of testing the doctrine and tactics now being taught.



A view of a terrain model as seen from the airborne command post

FIRST TO FAIL TO FLY

This report of ancient aviation accidents contains discussions of design features, flight conditions and pilot techniques. Although written in a lighthearted vein, the narrative is relevant to those who take to the skies in this century

Dr. Daniel S. Gray
Assistant Professor of History
Troy State University
Ft. Rucker, AL

WITH THE BIRTH of aviation history came the birth of aviation accidents. The very earliest documented attempts of flight in "heavier-than-air" craft are reports of accident. Even the legendary sagas of man taking wing all end with man taking a fall. It has often been said that the study of past accidents can prevent future mishaps. Judging this statement to be true, let's look at some dusty old accident reports filed and forgotten over the centuries.

Aircraft Accident Report #1

Synopsis: The crash of a single passenger aircraft (no registration number) off the coast of Italy. Time: Long ago in ancient Greece. Aircraft was destroyed in flight and the pilot received fatal injury.

History of the flight: The flight commenced as an effort by Daedalus and his son Icarus (the accident victim) to escape from King Minos of Crete. Daedalus designed and constructed individual aircraft consisting of feathers tied with string and fastened to the pilot's arms with wax (type unknown). Near dawn the two aircraft caught updrafts on the cliffs of Crete and departed in a northerly direction. While flying in formation Daedalus communicated a warning to Icarus not to fly too low lest the water wet his wings and make them heavy, nor to fly too high since the sun might melt the wax. Communication acknowledged. The aircraft passed the islands of Delos, Paros and Samos without incident, but Daedalus (the only witness to the accident) reports Icarus became overconfident and began "wheeling and soaring." In his delight he flew too near the sun thus melting the wax binding the wings to his arms. The aircraft disintegrated and the pilot fell into the sea and was drowned.

Injury to persons:

	Pilot	Others
Fatal	1	0
Nonfatal	0	0

Damage to aircraft: Destroyed in flight.

Crew information: Pilot was checked out in the aircraft by the designer but had no flight experience.

Aircraft information: Found to be of safe design when operated within design specifications.

Analysis and conclusions: Investigation revealed aircraft to be flightworthy and the pilot qualified. However, his disregard of a specific warning by the aircraft designer resulted in the accident. Probable cause of the accident: Heat from the sun melted wax binding wings of aircraft, resulting in its destruction.

Recommendations: Because of the lack of precedent, the FAA (Final Aviation Authority) has no standing recommendation for such an accident, but does suggest for future flights in such an aircraft that the wax be replaced by a high grade epoxy.

Only a legend, right? Couldn't possibly have any relevance to you? Wrong. Although men today fly with metal alloy wings and don't fear flying too near the sun, still we have too many who suffer from the "Icarus syndrome"—i.e., overconfidence and a short memory for warnings.

Aircraft Accident Report #2

Synopsis: Accident involving a single passenger aircraft near Bath, England. Time: 825 B.C. Aircraft was damaged in the crash and the pilot received fatal injury.

History of the flight: After having traveled to Athens to learn "secret arts," the pilot and aircraft designer, King Bladud of Britain, constructed (with aid from Satan) an aircraft which consisted of glider-type wings attached to the pilot's arms. Bladud attempted to fly in and around the site of present-day London; however, he crashed into a building and was killed. The aircraft was destroyed on impact.

Injuries to persons:

	Pilot	Others
Fatal	1	0
Nonfatal	0	0

Damage to aircraft: Aircraft destroyed on impact.

Other damage: The aircraft crashed into the Temple of Appolyn in London but did little damage.

Crew information: Pilot was not experienced but was more familiar with the aircraft than anyone else.

Aircraft information: Aircraft seemingly of untrustworthy design, but it was impossible to substantiate this since Bladud was killed

and his codesigner was not available for questioning.

Analysis and conclusions: The accident proved very difficult to investigate due to the destruction of the aircraft and the fact that no witnesses to the accident could be found. Also, the difficulty in locating the supposed codesigner was a hinderance to the investigation. Probable cause of the accident: Pilot error in that the pilot operated his aircraft at too low an altitude to safely avoid obstructions in his flight path.

Recommendations: Such flights in the future should take place in open areas far from temples and towns. We are happy to report that Bladud's son and successor, King Lear, informs us that he will never do such a crazy thing and hopes his subjects follow his sane example.

So you never heard of King Bladud, huh? And you don't plan to strap on any glider wings either? Fine, but the next time you may have to low level over an urban area remember Bladud and think.

Aircraft Accident Report #3

Synopsis: Accident involving a quadripedial-biplane near Malmesbury (England). Time: 1020 A.D. Aircraft was slightly damaged in the accident. The pilot received nonfatal injuries.

History of the flight: The aircraft designer and pilot, a well-known astrologer, inventor and monk—Oliver of Malmesbury—constructed a dual set of glider wings for his hands and his feet and became airborne from a tower in Malmesbury. Witnesses report the aircraft flew for "more than a furlong," but then the velocity of the wind became such that the aircraft became unstable and "fluttered down," causing the pilot to break both his legs.

Injuries to persons:

	Pilot	Others
Fatal	0	0
Nonfatal	1	0

Damage to aircraft: Aircraft was slightly damaged on impact.

Crew information: The pilot admits to have no other flight experience and stresses that he shall have none in the future.

Aircraft information: Aircraft found to be fully capable of lift requirements, though the stability factor remains uncertain.

Analysis and conclusions: The investigators had the full cooperation of the pilot in reconstructing the accident. Probable cause of the accident: It was suggested by the pilot and designer (Oliver) that had he not neglected to fasten a tail to his "hinder parts" to steady him in flight, perhaps the accident could have been avoided.

Recommendations: The investigators recommend that in the future aircraft of such design be provided with a tail assembly and that anyone attempting a flight in such an aircraft fly over something soft.

Design inadequacy . . . well, that's completely out of the pilot's realm of responsibility. Not really. If as an experienced pilot you spot a possible design defect, you bet your life you had better stay on the ground until you are proved wrong. You *are* betting your life if you just shrug it off by saying, "The slide-rule boys know best."

Aircraft Accident Report #4

Synopsis: Accident at the Hippodrome in Constantinople involving a single passenger aircraft. Time: mid-11th century. Aircraft was damaged and the pilot received fatal injuries.

History of the flight: In an announced public demonstration the pilot, known as the Saracen of Constantinople, attempted a flight around the Hippodrome. The aircraft, designed and constructed by the pilot, consisted of a long white robe braced with willow rods. The flight originated atop a high tower at the end of the Hippodrome. Witnesses, who included the Roman Emperor Comnenus and about 60,000 spectators, report that the Saracen stood "leaning into the wind" but appeared reluctant to begin the flight. The chanting of the crowd finally prompted him to become airborne. However, as a witness recorded, ". . . the weight of his body having more power to drag him down than the artificial

wings had to sustain him, he broke his bones." The pilot later died of his injuries.

Injuries to persons:

	Pilot	Others
Fatal	1	0
Nonfatal	0	0

Damage to aircraft: Aircraft was heavily damaged on impact.

Crew information: Pilot was the designer of the aircraft but had no flight experience.

Aircraft information: Investigators judge this type of aircraft incapable of lifting load attempted.

Analysis and conclusions: Investigation revealed that this aircraft was not flightworthy and that the pilot lacked training. Probable cause of the accident: Design error in lift capabilities, the pilot being too heavy for the aircraft to transport.

Recommendations: The FAA has repeatedly published precautionary matter concerning maximum allowable gross operating weights and their causative roles in accidents of this type. Should another flight of this kind be attempted, a crash diet is suggested for the pilot.

There are two lessons to be learned here: (1) Never exceed maximum allowable gross operating weights, and (2) resist the temptation to show off or you could break *your* bones.

Aircraft Accident Report #5

Synopsis: Crash of a glider-type aircraft at Perugia, Italy. Time: 1490 A.D. Aircraft was heavily damaged and the pilot received severe injuries.

History of the flight: The flight commenced when the pilot, Giovanni Battista Danti, became airborne from the top of a tall tower in Perugia. His personally designed aircraft consisted of linen wings braced with iron rods which, said witnesses, operated "with a horrible hissing sound." The flight proceeded as scheduled until an iron support in the port wing gave way. The pilot quickly lost control and the aircraft crashed into the street, badly injuring the pilot.

Injuries to persons:

	Pilot	Others
Fatal	0	0
Nonfatal	1	0

Damage to aircraft: Aircraft was heavily damaged on impact.

Crew information: The pilot had extensive experience in this type aircraft having previously accomplished several flights over Lake Trasimento earlier in 1490.

Aircraft information: Aircraft had been thoroughly checked out by the pilot before the flight and had proven itself of reliable design.

Analysis and conclusions: Investigation showed the pilot to be experienced and the aircraft trustworthy. Probable cause of the accident: Structural weakness of iron support caused it to break and allowed the port wing to collapse. The investigators believe that a strong possibility of metal fatigue exists in the failed structure.

Recommendations: While the investigators in no way condemn the design of this aircraft, we do recommend that extensive tests be conducted on structural supports and that as a precaution further flights might well be conducted over the lake.

A simple preflight check could have prevented this ancient accident. How many have you seen or heard about that would never have happened if preflights had been properly completed?

Aircraft Accident Report #6

Synopsis: Accident involving a 47 engine Rocket-Kite in central China. Time: 1500 A.D. Aircraft and pilot were completely destroyed in the accident.

History of the flight: The designer and pilot, Wan Hoo, attempted a flight in an aircraft consisting of a saddle mounted between two large kites, powered by 47 rockets. The flight was witnessed by 47 coolies who, at the signal from Wan Hoo, each lit a rocket. The surviving witnesses reported that the pilot and aircraft disappeared "with much noise and smoke."

Injuries to persons:

	Pilot	Others
Fatal	1	some
Nonfatal	0	some more

Damage to aircraft: Judged to be extensive from the larger pieces found.

Crew information: Pilot was making his first solo flight. The ground crew were experienced with skyrockets and fireworks.

Aircraft information: Aircraft was of such a hybrid nature specification norms for it have not yet been established. However, the design does appear to have serious drawbacks.

Analysis and conclusions: The investigation has been difficult since the nature of the aircraft has led to jurisdictional disputes among the FAA and the Cavalry. However, it is agreed that the probable cause of the accident was the excessive charge of powder placed in each rocket by the designer.

Recommendations: The FAA recommends that the test flying of such aircraft be confined to unmanned attempts in the future.

The saga of Wan Hoo should remind us all of the role of *common sense* in flying. He, rest his soul, appears to have had just about none.

Aircraft Accident Report #7

Synopsis: Accident involving a man-powered ornithopter on Swan Mountain near Florence, Italy. Time: 1505 A.D. Aircraft destroyed on impact. The pilot received nonfatal injuries.

History of the flight: The aircraft, designed by Leonardo da Vinci, was launched from Swan Mountain (elevation 1,300 feet) near Florence. It was piloted by Zoroastro da Peretola. Unable to sustain flight by operating a rowing mechanism to flap the wings, the pilot and aircraft rapidly lost altitude and crashed. The pilot suffered a broken leg.

Injuries to persons:

	Pilot	Others
Fatal	0	0
Nonfatal	1	0

Damage to aircraft: Aircraft destroyed on impact.

Crew information: Pilot had long assisted Mr. da Vinci and may have had previous experience and logged several seconds flying time.

Aircraft information: Very scanty information is available on the aircraft since both the designer and the pilot are reluctant to talk about the whole thing.

Analysis and conclusions: Because of the refusal of the designer and surviving pilot to discuss "The Bird" (as da Vinci calls it), the investigation is incomplete. Probable cause of the accident: Inability of the pilot to flap hard enough to fly.

Recommendations: The FAA recommends that aircraft of this design be discontinued because of the unsuitable power source and that the designer, Mr. da Vinci, pursue some earthbound hobby—like painting.

This accident should tell us something about trusting in reputations. "The Bird" was a genuine da Vinci, designed and built by the greatest genius of his day. Fortunately, the pilot didn't have to pay with his life for trusting in that reputation. He found that a famous name on the side of an aircraft in no way guarantees its flightworthiness. Also, he discovered that previous flying experience can never make a pilot crashproof.

Aircraft Accident Report #8

Synopsis: Accident involving a single passenger glider-aircraft at Stirling Castle, Scotland. Time: 1507 A.D. Aircraft slightly damaged in crash. Pilot sustained nonfatal injury.

History of the flight: The designer and pilot, John Damian, the court physician to King James IV, took flight from the castle wall in an aircraft consisting of glider wings strapped to the pilot's arms. Unable to support the weight of the wings, Damian's arms dropped and the crash resulted. The pilot suffered a broken thigh bone.

Injuries to persons:

	Pilot	Others
Fatal	0	0
Nonfatal	1	0

Damage to aircraft: Aircraft slightly damaged on impact.

Crew information: Pilot is a well-known alchemist and doctor, but had no flight training or experience.

Aircraft information: Of unapproved design, wing surface sufficient to lift desired load, but the wings too heavy to be supported by the pilot's arms.

Analysis and conclusions: Although the surviving pilot was very eager to aid the investigators, we do not accept his explanation of the accident. Damian said the aircraft crashed because it was constructed of hen feathers "which displayed a natural preference for the farmyard rather than higher altitudes."

Recommendations: If the pilot should again attempt a flight in the same aircraft, we recommend a quick weight-lifting program and a lower wall.

Although no aircraft today are constructed of hen feathers, Damian's explanation of the cause of the accident points to a bad habit of present day aviators. How easy it is to blame an incident or accident on the aircraft, the weather, or *anything* else except the fact that the pilot might have gone beyond his capacity—because of either lack of training or fatigue.

The drone of aircraft engines overhead quickly can bring us back from these early black and blue days of aviation history. Amusing though these accounts of ancient would-be aviators are, they also can be instructive. The aircraft have changed but the causes of these accidents are still with us: pilot error, overconfidence, failure to heed warnings, design inadequacies and pilot fatigue.

Dr. Gray wishes to acknowledge the technical assistance given by Captain Ronald P. Hemby, U. S. Army Aircraft Investigation Board, Ft. Rucker, AL

VIEWS FROM READERS

Continued from page 1

survivors and the crew was feared lost. But after several passes they were detected—by spotting Dave's copilot lying on his back in a little clearing pointing the strobe light skyward. The strobe light saved them!

I don't remember if Dave mentioned this in his article or not, but, as I remember it, the only difficulty they experienced with the survival equipment was that they had to cut the strobe light out of its pouch. The little snap wouldn't unsnap.

That chicken plate has some history—twice shot down with me, once with CPT Bristow, and I gave it to a fairly new arrival when I left RVN in October 1969. I wonder what other experiences it has gone through since October 1969?

CPT D. L. Grieger
IOAC 5-72
Ft. Benning, GA 31905

Sir:

Some months ago you published an article on the folding of a tactical map for easy reading. Unfortunately, my copy of that issue has been misplaced. I would appreciate it if you could send me a copy of the article or the issue. Thank you for your help and interest.

1LT James J. Morris
HHB 9th Divarty Avn Sec
Ft. Lewis, WA 98433

• The article you referred to was entitled "The Tactical Map and You" and was authored by CW2 Nile L. Harter Jr. The DIGEST continues to receive letters requesting copies of this fine article which appeared in the October 1970 issue. A copy of the article has been forwarded to LT Morris and to others who have written in requesting it.

Sir:

In the August issue of the DIGEST there was a test entitled "The Perfect Pro." I do not fly any type of aircraft but I took the test and passed with a perfect zero.

On occasion I have and probably will fly in different types of aircraft and if any of the pilots did not pass please excuse me if I do not fly with them.

SP5 Harry R. Norris
258th PSC
APO San Francisco 96331

INSTRUMENT CORNER

Q. My question has to do with a proper entry into holding by means of a teardrop entry. I first learned in 1965 that I should track outbound on a track of 30 degrees or less from the outbound course and track interception was not mandatory after 1 minute. TM 1-225, dated April 1965, and present Federal Aviation Administration procedures verify this. However, later versions of TM 1-225 and DOD FLIP, section II, have changed the word track to "course." Some interpret this new wording to mean heading. I would like to know, is it mandatory to track outbound in the initial turn or just use a heading?

A. Entry into holding as explained in DOD FLIP, section II, and TM 1-225 is fairly explicit in that they use a navaid as a holding point. The teardrop course is described as being 30 degrees or less outbound from the holding course on the holding side. The teardrop entry is an optional method of entry. It can be used when the heading of the aircraft is conveniently aligned with the teardrop course. Course interception is not mandatory prior to turning inbound.

Upon entering the holding pattern (using the teardrop method) the aviator should choose a teardrop course of 30 degrees or less outbound from the holding course. An attempt should be made to track outbound on this course for 1 minute but course interception is not mandatory. When turning inbound the first time, course interception is again not mandatory. Proceeding direct to the holding fix is acceptable.

When holding at an intersection (Airman's Information Manual, part 1) there is no facility to provide course guidance for the teardrop course. The aviator should choose a heading (based on his knowledge of winds, etc.) that will yield a teardrop track of 30 degrees or less outbound from the holding course. Air speeds for holding are also found in the references below.

References: TM 1-225, dated December 1968, page 13-13, paragraph 13-19c; AIM, part 1, dated August 1972, page 1-59, paragraph 4a, (3), (b); FLIP, section II, dated 17 August 1972, page II-83, paragraph 2 (3).

Aircraft Mine Delivery

Army helicopters will soon be able to emplace self-destructing land mines freeing the maneuver forces to perform their mission of closing with and destroying the enemy

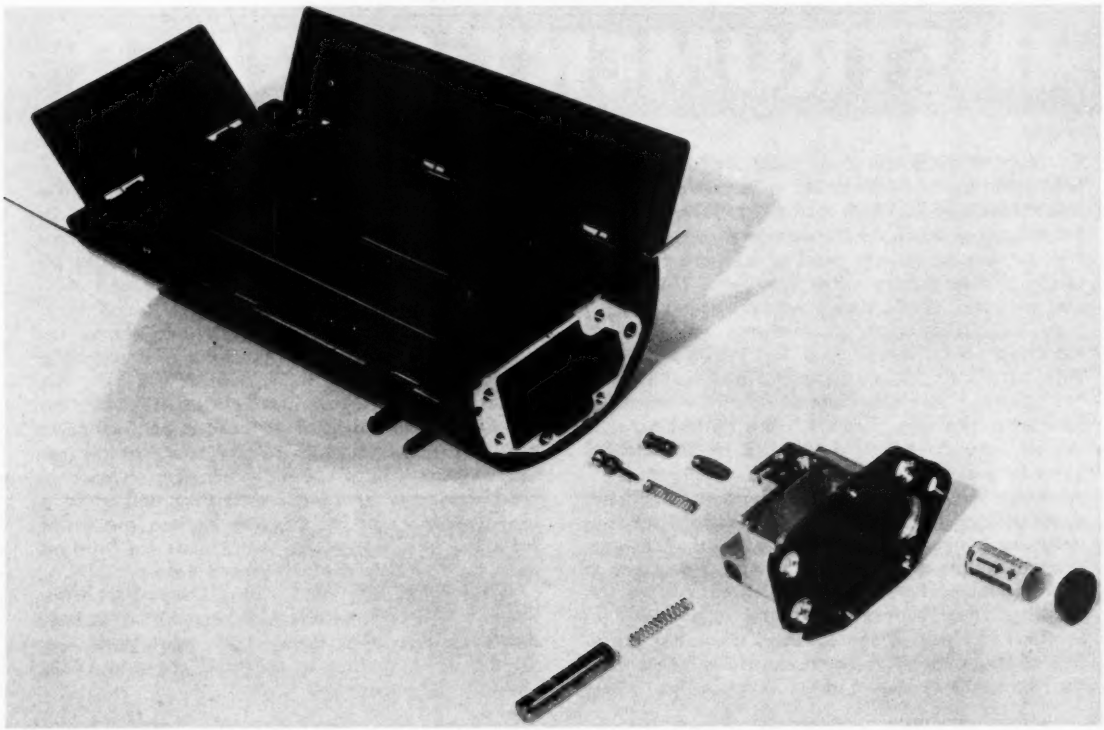
Captain Wayne F. Reposa

FEW, IF ANY, will question the tactical value of a well-employed minefield. Mine warfare has provided the commander with a tool to enhance his combat effectiveness by weakening the enemy both physically and psychologically.

In past conflicts minefields have been employed to deny or restrict key terrain, canalize, disorganize and harass enemy ground forces, but not without high costs to the friendly forces. The employment of conventional mines requires significant manhours, enough to sap the strength of maneuver forces. Whole maneuver units have been required to deploy mines and mine barriers. Also, when the mine obstacle was no longer needed, additional fighting strength was consumed in its removal. Old minefields not immediately removed impeded movement and endangered the civilian populace.

Soon Army aviation will be in a position to significantly reduce the minefield emplacement burden and free more maneuver forces to perform their primary mission of closing with and destroying the enemy. The emergence of scatterable mining concepts, coupled with the development of the XM-56 aircraft mine dispenser, has opened new horizons in mine warfare. Army utility helicopter, e.g., the UH-1H, will be capable of air delivering scatterable, self-destructing antitank/antivehicle/antipersonnel mines when developed. The XM-

Exploded view of the XM-34 at mine



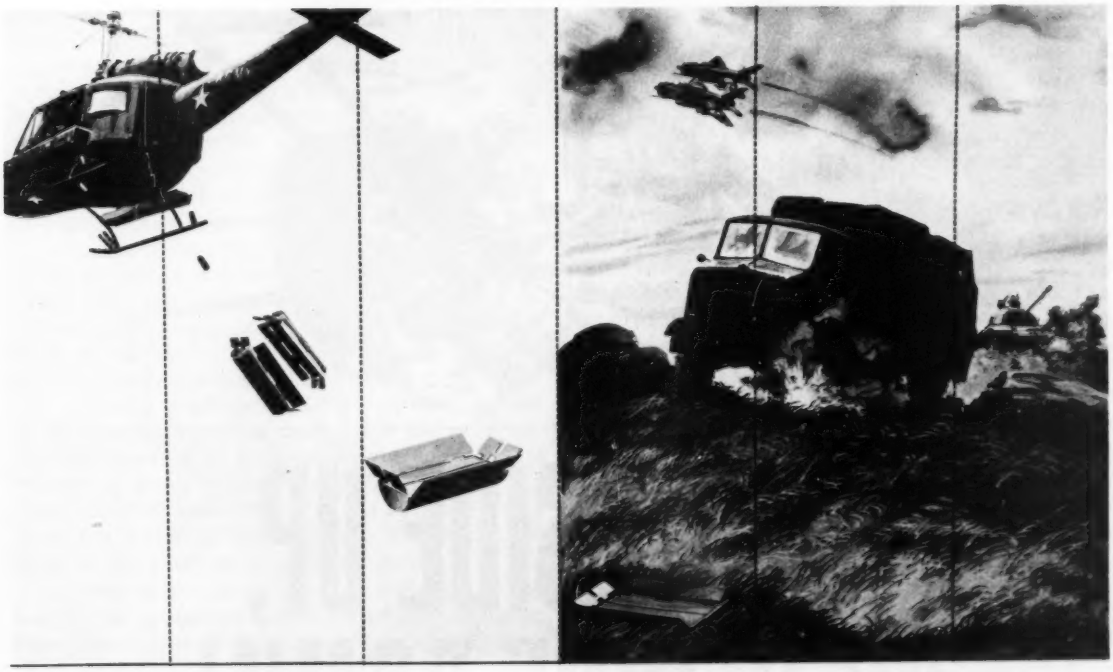
56 aircraft mine dispenser system will enable one UH-1H utility helicopter with its normal crew to lay a minefield larger than a football field in the span of a few seconds. Successive flights or multiple aircraft flights will be capable of laying a barrier system in a few hours. At the end of a predetermined period the scatterable mines will self-destruct, rendering the area again safe for forward movement and civilian safety.

The XM-56 system consists of two bomb dispensers—SUU-13/A—two mounting racks and a fire control system. The SUU-13/A dispenser is rectangular in shape with a rounded top surface, an aerodynamic nose fairing and a flat rear fairing. Two suspension lugs are assembled to the dispenser for attaching the dispenser to the aircraft. The fire control system consists of a fire control panel and a wiring harness. This system provides the air crew with the capability for manual or automatic dispensing of munitions with a precise, controlled interval between each mine or pair of mines being dispensed.

In future conflicts mine employment will no longer be limited to defensive postures. The XM-56 system will enable the ground commander to integrate mine warfare with his offensive maneuvering by obstructing enemy routes of communications, cutting his supply lines, blocking avenues of approach or retrograde, and denying him his ground reinforcing capability. Self-destructing, scatterable, aircraft delivered minefields can be employed continuously in support of the tactical and strategic operations against enemy ground forces and logistic support activities in any area in the world to delay, obstruct, canalize or interrupt his movement over terrain; to attentuate, disorganize or harass his forces; and to deny him use of selected areas or facilities over periods of time selected by the tactical commander. Employment of these minefields will broaden the horizons of mine warfare and free the ground maneuver forces to engage and destroy the enemy while enhancing economy of force operations.

The XM-56 system represents one more way in which Army aviation is increasing the Army's fighting efficiency.

Sequence of operations for XM-56 mine dispersing subsystem



Gene Berta
Directorate for Education and Prevention
USAAAVS

IN THIS, the last article in the series, we want to look at a number of factors that affect the disorientation phenomenon. These include what we term mission-related factors (type of helicopter, time of day, etc.), meteorological conditions, flight instruments and sources of light. The survey included questions designed to elicit information from rotary wing aviators in each of these areas. The analysis of the answers is the subject of the next few paragraphs.

According to the helicopter pilots who responded to the questionnaire, the type of helicopter had little or no effect on disorientation. The magnitude of a

RIGHT SIDE UP, OR UPSIDE DOWN?

disorientation episode was essentially independent of the helicopter type (CH-47, UH-1, OH-6, etc.).

Although the type of helicopter did not matter, whether the aircraft was flown alone or in formation was significant. Rated pilots reported that 30 percent of their disorientation episodes had taken place in formation flight. As mentioned in an earlier article, aviators seem to become especially susceptible to disorientation during formation flight, perhaps owing to "fascination in flying." Apparently, they ignore aircraft orientation as they become progressively preoccupied with the chores of formation flying. A substantial number indicated that they became disoriented while looking at the aircraft ahead of them in a formation.

Altitude had little impact on the frequency or magnitude of disorientation episodes with one major exception—low-level flight at altitudes of 100 feet or less. Twenty percent of the aviators said they had experienced disorientation at these altitudes. The importance of this information lies in the critical relationship between altitude and the time to recover from an episode before a crash. At these heights above the ground, additional elements such as fog, dust and features of the terrain increase the likelihood of disorientation episodes, and aviators have too little time to recover. Depending upon the magnitude of the episode, it is doubtful that a disoriented pilot would have time for a successful recovery using instruments. This factor becomes particularly significant when we note that rated pilots categorized 15 percent of all disorientation episodes that occurred below 100 feet as severe, while categorizing only 11.1 percent of the episodes occurring above 1,500 feet as severe. Aviators reported 15 orientation-error episodes that resulted in major accidents, and eight of these episodes occurred within 99 feet of the terrain. Table 1 shows the percentage and magnitude of disorientation episodes that occurred at various altitudes.

Answers to one survey question pertaining to the role that fatigue played in the aviator's disorientation experience indicate that fatigue had a slight effect on the magnitude of the episodes, with the pilots reporting that they felt fatigued in 27.5 percent of the mild episodes and in 34.6 percent of the severe episodes. When asked how long they had been airborne before the disorientation episode occurred in which they felt fatigued, pilots reported an average time of three-fourths of an hour.

Aviators were given 12 descriptors of meteorological conditions from which they could choose up to three as best describing the conditions prevailing at the time of their disorientation episode. As the largest number of student pilots selected "broken," "haze," "ragged" or "smoke," it seems evident that limited visibility was a principal factor contributing to their disorientation.

The response of rated pilots was more diverse. They encountered disorientation most frequently while the weather was "overcast." Although rated aviators reported only a very small proportion of all disorientation episodes as taking place while snow was falling, 22 percent of these episodes was severe. The distribution of pilot response shows that episodes occurring under conditions of limited visibility resulted in severe disorientation in approximately 15 percent of the episodes. The extent to which limited visibility is involved in disorientation is illustrated by the fact that only 22.4 percent of the student pilot episodes and only 9.2 percent of the rated pilot episodes occurred under CAVU (ceiling and visibility unlimited) conditions.

In reply to a question about the clarity of the horizon, rated aviators reported more than twice as many episodes when the horizon was completely obscured than when it was distinct or partially obscured. One out of every four of these episodes was severe. Again, it can be seen that limited visibility is a principal factor in pilot disorientation.

The time of day that disorientation occurred was different for the student and rated pilots because of the student training environment. The students di-

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This is the last in a series of articles based on a soon-to-be published technical report, "Disorientation in Rotary Wing Aircraft: An Appraisal of the Experiences of U. S. Army Rotary-Wing Qualified Aviators," by Stewart Lyons, Emil Spezia and LTC Charles Mateer, Applied Research Division, Directorate for Technical Research and Applications, U. S. Army Agency for Aviation Safety, 1972. This report analyzes the answers of over 5,500 rotary wing aviators who responded to a survey questionnaire on disorientation experiences.

TABLE 1

Altitude Above the Ground at Which Aviators Became Disoriented (Percent)

	0' to 99'	100' to 199'	200' to 299'	300' to 399'	400' to 499'	500' to 599'	600' to 699'	700' to 799'	800' to 899'	900' to 999'	1000' to 1499'	1500' to Higher	All Altitudes
STUDENT PILOT RESPONSES													
Mild episode	30.4	33.3	59.1	42.1	45.4	52.0	71.4	69.2	33.3	57.1	47.6	56.7	49.2
Moderate episode	59.1	61.1	31.8	50.0	36.4	39.8	23.8	23.1	55.6	35.7	47.0	37.8	43.5
Severe episode	10.5	5.6	9.1	7.9	18.2	8.2	4.8	7.7	11.1	7.1	5.4	5.5	7.3
RATED PILOT RESPONSES													
Mild episode	26.1	20.0	27.6	22.0	34.1	29.2	52.0	25.9	38.7	23.1	40.1	45.4	34.8
Moderate episode	58.9	64.0	51.7	57.6	51.2	54.2	36.0	63.0	41.9	65.4	48.8	43.5	51.4
Severe episode	15.0	16.0	20.7	20.4	14.7	16.6	12.0	11.1	19.4	11.5	11.1	11.1	13.8
TOTAL RESPONSES	20.0	3.4	4.0	4.8	3.2	8.4	2.3	2.0	2.4	2.0	15.4	32.1	100.0

vided their experiences between day and night, but the rated pilots reported that nighttime disorientation episodes were most frequent. As visibility decreased, the incidence and severity of disorientation episodes increased. Even though significantly more flying is done during the day, rated aviators experienced almost twice as many disorientation episodes at night as during the day.

We were also interested in the relationship between flight rules in effect when the pilot became disoriented and the type of flight in which he was actually engaged (instrument or contact). The answers to the questions dealing with these two items are shown in table 2. Most aviators flying with instrument flight rules in effect were switching from instrument flight to contact. This practice of mixing instrument and contact flight is bad because, according to disorientation studies, it induces disorientation.

Bearing in mind the predominantly limited-visibility conditions described as prevailing at the time of disorientation, the distribution of responses in this table indicates a need for improved aviator training and improved helicopter instrumentation. As noted previously, over 75 percent of all disorientation episodes occurred during conditions of limited visibility. According to table 2, approximately 90 percent of the students and 80 percent of the rated pilots were flying with visual flight rules in effect, regardless of the visibility. These percentages are to be expected, however, because most helicopter flying is done at altitudes of 1,500 feet and below, and at these altitudes, aviators are inclined to fly contact. They are so inclined probably because they do not trust aircraft instrumentation, particularly in rotary wing aircraft, enough to fly instruments at these altitudes. It may be significant that, in each major accident reported as a result of orientation error, the pilot was switching from instruments to contact.

We were also interested in the role of flight instruments in disorientation. Only 2.8 percent of aviators experiencing disorientation reported malfunctioning instruments. Difficulty in reading or interpreting flight instruments increased with the magnitude of the disorientation episode. This was to be expected. Aviators experiencing mild disorientation are exposed to mild false sensations and illusions. Severely disoriented aviators are exposed to extremely hazardous false sensations and illusions as well as high levels of anxiety that make it increasingly difficult to read or interpret flight instruments.

The flight instrument both student and rated aviators most frequently found difficult to interpret was the attitude indicator. Forty percent chose the attitude indicator with the heading, airspeed, vertical speed and altitude indicators following in that order. Four aviators who reported major accidents as a result of orientation error had difficulty in interpreting the attitude indicator during the disorientation episode leading up to the accident.

Most experienced aviators are aware of the disorienting effects of lights and are alert for the combination of light sources and flight conditions most likely to produce disorientation. Much of their knowledge, because it is frequently reported, seems to be based on experiences in fixed wing rather than rotary wing aircraft. We listed 14 conditions in the question-

TABLE 2
Whether Aviator Was Flying IFR or VFR and Switching From Instruments to Contact (Percent)

	STUDENT PILOT	RATED PILOT
MILD EPISODE		
VFR	91	77
IFR	9	23
Not switching from instruments to contact	91	78
Switching from instruments to contact	9	22
MODERATE EPISODE		
VFR	94	80
IFR	6	20
Not switching from instruments to contact	95	79
Switching from instruments to contact	5	21
SEVERE EPISODE		
VFR	93	83
IFR	7	17
Not switching from instruments to contact	86	80
Switching from instruments to contact	14	20

naire that were gathered from discussions with helicopter pilots and from mishap reports on file. These conditions fall into three major groups: light from reflected sources, light from a single source and sudden loss of night vision.

The largest percentage of the experiences reported involved the reflected light group. The interrupted/flicker type of reflected light accounted for 30.5 percent of all experiences reported. This type includes sunlight through rotor blades, flashing navigation lights and rotating beacon light reflecting on various surfaces. Aviators reporting disorientation experiences involving reflected light mentioned sensations of spinning, turning and weightlessness, as well as feelings of uneasiness, dizziness and nausea. Some even reported that their minds went blank momentarily.

A single light source was reported in 23.3 percent of the episodes, especially those experienced by student pilots.

Sudden loss of night vision because of landing lights, searchlights, flares, etc., made up 14 percent of the total. These were reported mainly by aviators who had flown combat missions.

There are, of course, other questions we could have asked these pilots, but this survey was not intended to be an exhaustive study of disorientation. We wanted firsthand descriptions of disorientation episodes actually experienced by rotary wing aviators to add to the body of knowledge of disorientation and its symptoms. Over half of the 5,500 aviators who responded to the survey had experienced disorientation and took the time to describe these episodes. The major findings of our analysis of their answers are as follows.

- A high percentage of the episodes occurring during landing and takeoff were classified as severe.
- One of every two disorientation episodes occurred during straight and level flight. The landing phase of flight also accounted for a large number of disorientation episodes, probably as a result of the increased hazards at ground level such as fog and dust.
- The age of the aviator did not influence the magnitude of the episode. Older pilots with more flight experience were as likely to experience mild, moderate or severe disorientation as younger pilots with less experience. In addition, the pilot's age had no apparent effect on his susceptibility to disorientation episodes in which fatigue was a factor.
- At least one-half of the aviators surveyed first experienced disorientation while holding a tactical

instrument rating. A larger proportion of aviators holding higher instrument ratings had experienced disorientation because of their greater exposure to the more severe flying conditions.

• Almost half the responding pilots considered their ability to fly a helicopter in instrument flight as less than proficient. One in five aviators considered his training inadequate.

• The elapsed time between pilot's instrument flight training and his disorientation episode directly affected the magnitude of the episode. The longer it had been since his training, the more severe the episode.

• More than half of the aviators said they were "relaxed, with everything under control" at the onset of disorientation. Many others said they were "looking straight ahead," "using a single light or star as a guide" or were "straightening up their heads from looking down and back."

• As the magnitude of the episode increased, aviators were more inclined to turn the controls over to a second pilot, if one was available.

• Many pilots said they ignored the instruments and relied on outside references during the more severe episodes.

• A significant number—30 percent—of pilot disorientation episodes occurred during formation flight.

• Both frequency and magnitude of disorientation episodes increased at altitudes below 100 feet. This increase was attributed to the additional hazards at these altitudes, such as fog, dust and terrain.

• Fatigue caused a slight increase in the number and magnitude of disorientation episodes, but age was not a factor in fatigue-affected episodes.

• Only 22.4 percent of student pilot episodes and 9.2 percent of the rated pilot episodes occurred under CAVU conditions. Conditions of limited visibility prevailed at the time of the other episodes.

• Despite the limited-visibility conditions, about 90 percent of the students and 80 percent of the pilots were flying with VFR weather in effect.

• Aviators had more difficulty reading and interpreting the attitude indicator than any other flight instrument. Difficulty in reading this instrument was a factor in four major accidents involving orientation error.

What the 5,500 helicopter pilots shared with us of their experiences has yielded some valuable guidelines for the commander and the aviator that should be both enlightening and helpful in the conduct of an effective accident prevention program.

As a commander, you can help reduce the incidence of orientation error and its sometimes catastrophic results by:

• Making sure your aviators receive frequent instrument flight training that provides a realistic environment in which they can become familiar with conditions and circumstances conducive to disorientation, and in which they can learn how to avoid orientation error once they become disoriented.

• Realizing, and acting upon the realization, that dual flight is much safer than solo flight, especially under conditions of limited visibility.

• Considering the fatigue factor as you schedule flights.

As an aviator, you should look out for disorientation when:

• You are relaxed and looking straight ahead.
• You are switching from instruments to contact.
• The horizon is partially or completely obscured.
• You are flying straight and level with visibility less than CAVU.
• You are flying in formation.
• You are using a single light or star as a guide.
• You begin to tire.
• Reflected light impinges on your vision.
• You encounter fog and dust at low altitudes (less than 100 feet).
• You take off and land under anything less than conditions of ideal visibility.
• You focus your attention on some object removed from the aircraft.
• You move your head to tune your radio, etc.

In addition, you will be more likely to recover from disorientation without making an orientation error if:

• You undergo frequent instrument flight training.
• You rely on your instruments rather than on outside visual references in your effort to recover.
• You are not too confident in your own capability and are willing to turn the controls over to your copilot.

If these recommendations, gleaned from the experiences of many rotary wing pilots, are heeded, the men who fly helicopters should be better prepared to know at all times whether they are RIGHT SIDE UP, or UPSIDE DOWN.

ATC Responsibilities

Are ATC agencies responsible for issuing weather advisories to pilots?—Aviator

Only within certain limits. ATC responsibilities fall into three priorities: first, separation of aircraft; second, services required that do not involve separation of aircraft; and, third, additional services to the extent possible.

A local FAA representative categorizes PIREPS as second priority. The manual states, "Relay significant PIREP information to other aircraft concerned and to [appropriate agencies]."

In most cases, weather information is noted as an "additional service," third priority. For example, the ATC manual includes as an additional service, "Issue pertinent information on radar-observed weather and chaff areas and suggest radar navigational assistance to avoid these areas. Provide this assistance only when the pilot requests it, whether or not you have previously suggested it." However, ATC will vector IFR aircraft "when it is necessary for separation purposes, required for noise abatement considerations, there is an operational advantage to the pilot or controller, or when requested by the pilot. . . ."

Also listed in the ATC manual as an additional service is, "Plan ahead and suggest use of alternative routes to avoid known areas of significant weather. Expedite action on requests for route or altitude deviation to avoid areas of significant weather." A catchall paragraph says, as another additional service, to issue a safety advisory "to radar identified aircraft whenever radar observation reveals a situation which, in your judgment, is likely to affect the safety of the aircraft."

Nomex Gloves

Why are Nomex gloves considered to be better than leather?—ASO

The flame protective qualities of Nomex gloves are not better than those of leather, but the Nomex gloves are cooler to wear, are easily laundered, do not dry out and crack after repeated wettings, and remain pliable.

Flight Jackets

Why does the Army still issue nylon flight jackets when all flight surgeons I've talked to say leather is more fire retardant? One flight surgeon says he has treated burns, especially on the neck and wrist, that he feels could have been lessened if the flight jacket had not melted on them.—ASO

The U.S. Army Aviation Test Board is now testing two versions of a Nomex cold weather flight jacket. One features a sewn-in quilted lining and Spandex cuffs and waistband, while the other has a removable liner and Velcro wrist and neck features. If these jackets prove acceptable, you can expect field issue in FY 1975.

If you have a question concerning aviation accident prevention, write to
CO, USAAAVS
ATTN: Orval Right
Fort Rucker, AL 36360

Two-Piece Flight Suit

Why did the Army purchase the two-piece Nomex flight suit rather than the one-piece suit purchased by the Navy and the Air Force? It is all too possible a person could sustain burns on his back if his shirt and trousers have separated.—ASO

The decision to buy the two-piece Nomex suit was made at DA level, and the reasons were not detailed at the time. It is anticipated that tails of shirts procured in the future will be lengthened to reduce the hazard.

THAT FRIGID OLD MAN . . . is here again

Ted Kontos, *Directorate for Education and Prevention, USAAAVS*

HEY! WINTER is here! Winter is here! . . . What's that, captain? So what else is new? Winter gets here about this time every year? . . . It does at that, doesn't it? Actually, with all the snow and ice on the ground, I thought this might be a good time to pick up some helpful tips on winter flying to pass along; and I figured that maybe if I came out here to operations, some qualified individual might help me out.

"I see you're an aviator and you have your bag with you. Are you getting ready to do some flying? . . . You are! Well, if you can spare me a few minutes, I'd like to ask you some questions. . . . Fine! Why don't we go into the snack bar and talk over a cup of coffee!

"As a starter, I see you're wearing your winter

greens and not a Nomex flight suit. Would you care to comment? . . . You-look-cuter-in-winter-greens! . . . Now what kind of an answer is that? Next, you'll probably tell me you're wearing nylon thermal underclothing instead of wool, which, of course, is the approved type. Right? . . . You're-not-wearing-thermal-underclothing. Just the regular kind. Besides, wool makes you itch! . . . I hate to say this, captain, but—I mean—with all the information concerning personal safety that's been published—what if you had an accident? Or even a forced landing somewhere in the wilderness? You could freeze to death before anyone could find you. And if there was a fire—well, everyone knows the difference Nomex can make. . . .

"I can see we're not getting anywhere with this topic, so let's talk about winter preflights. We all know the importance of a thorough preflight, but in winter it becomes doubly important to find and correct discrepancies before they can cause inflight emergencies. Remember, what might normally be a forced landing can easily turn into a major accident when an aircraft must be set down on snow-covered terrain. Unknown depth of snow and snow-covered obstacles, as well as irregular terrain and the possibility of blowing snow and strong winds, can literally ruin a pilot's day. But preflights in winter are somewhat hazardous—cold burns can result from touching frozen aircraft surfaces, and falls from slipping on icy wings and platforms—what precautions to prevent personal injury did you take when you pulled your preflight this morning? . . . You-didn't-pull-a-preflight. . . . Let me rephrase it. When you go out there to pull a preflight before you take off, what precautions are you going to take? . . . You don't have to worry about personal injuries because you're not going to pull a preflight! . . . Okay! I assume that someone else has performed the preflight inspection for you. . . . You what? You-certainly-hope-so? I hope so too, captain.

"I'll say one thing: You're a happy sort. How can anyone be so complacent and jovial? . . . It's-the-holiday-season! . . . I know it's the holiday season. But the preflight is still important. Look! Just suppose your mechanic forgot to tighten the spark plug leads on your engine, and they come loose when you're over some remote, heavily wooded area. Doesn't that possibility worry you? . . . Not-at-all! . . . And why not, may I ask? . . . Because unless some practical joker has switched engines on you, your gas turbines don't have spark plugs!

"Tell you what. Let's say you're ready for flight and are about to taxi to the runway. Now, portions of the ramp are covered with ice, and lots of pot holes filled with water are scattered along the taxiways. This water can get into your wheels and freeze during flight, and when you're ready to land, your wheels may be locked. What's your answer to this problem? . . . Big-wheels-and-tires! . . . Don't ask me why, but I'll accept that. I suppose big wheels and tires would do it!

"Let's move on to the big problem—weather. Do you know that right now a major cold front is heading this way from the northeast—that high winds, ice and snow are predicted for this area? Are you prepared to cope with this weather? . . . You-don't-have-to. . . . And why not? . . . You're going south, and the man on TV said the weather there is dry, mild, with no prospect for change within the next 24 to 48 hours—THE MAN ON TV! Is that where you get your weather information? . . . That's where you got this report. . . . Would I what? . . . Would I like to come along? . . . Do I look like some kind of nut? . . . What's the shoulder shrug supposed to mean?

"One more question: How much time do you have in type aircraft? . . . You've-never-been-checked-out-in-it! . . . You've got to be kidding! You're pulling my leg! Right? . . . You're-not-pulling-my-leg. . . . Tell me, what kind of a CO do you have, anyway? . . . A-darn-good-one? One who approved your Christmas leave, and you're on your way home now —747—all the way to Miami! . . . Same to you, captain—MERRY CHRISTMAS!"

And a MERRY CHRISTMAS to you, too! You can help make it a merry one by knowing the hazards associated with winter operations, taking proper preventive measures, and following correct procedures.

Granted, weather conditions vary in different parts of the world, and in some areas, special precautions must be taken. For example, arctic winters are so severe that when an aircraft is to remain idle overnight or for an extended period of time, the oil must be drained after the engine is shut down, the battery removed, and both stored in a heated shelter. But the following facts have wide application and should be kept in mind.

BEFORE FLIGHT

- Select clothing for both safety and warmth.
- Make thorough flight plans, paying particular attention to weather forecasts and selection of alternate airfields, and ensure an ample fuel reserve. Evaluate missions as to need and avoid unnecessary risks. Know your capabilities and stay within them. Similarly, operate within the limitation of your aircraft. Is it fully instrumented for IFR flight? Does it have anti-icing equipment?
- Exercise caution around aircraft to prevent personal injuries from falls, contact with frozen metal

surfaces and hazards associated with cold weather.

• Perform thorough preflights and cockpit checks. Be especially observant for water in fuel, remembering that soon after servicing, water may be held in suspension and be difficult to detect. Make certain pitot and static ports are open and that the pitot heating element is functioning properly. Make sure tires and skids frozen to the ground are properly freed before attempting to move aircraft. Frost, snow, frozen ice particles or just ice on top of wings, rotor blades and stabilizers should be removed prior to flight. Pay particular attention to air intakes and check anti-icing equipment.

• Warm up cabin to maintain clear windshield and allow instruments to function better.

TAXIING

• Check condition of ramps and taxiways for ice, water, etc. Nose wheels and tail wheels are not effective on wet or icy ramps—EXCEPT AT SLOW SPEEDS. Use wing walkers when needed and allow yourself lots of space. Apply brakes smoothly, and avoid taxiing through deep water.

PRETAKEOFF

• Check surrounding area before making runup so as not to blow snow and slush over other aircraft, runways or taxiways. Remember pitot heat, and use it. On reciprocating engines, apply carburetor heat for a short period before takeoff—it is just as important to use before takeoff as during landing, when conditions warrant its use.

ICE

• Since heavy cloud turbulence usually means heavy icing conditions, skirt obvious danger areas. Also, try to avoid flight through rain or wet snow when the temperature at flight level is freezing or slightly below. This combination of moisture and temperature is highly conducive to icing. Remember, about 85 percent of aircraft icing occurs in frontal zones. Since typical cold front clouds are cumuliform, flying parallel to such a front may cause the formation of clear ice on aircraft surfaces, which is more difficult to remove than rime ice.

If ice forms on flight surfaces, make turns shallower than normal. Similarly, since the stalling speed increases when an aircraft is "iced," maintain adequate air speed in climbs and glides, and land with power.

If ice has accumulated on a helicopter, avoid making steep approaches. Make all control movements smoothly. (Note: Dynamic efficiency of *propellers* and *rotor blades* is lowered when ice changes blade profiles. Deicing of propellers is aided by alternately increasing and decreasing rpm so that air friction and propeller vibration can act to break off ice. Rapid changes in pitch will help to shake the ice from rotor blades as well as propellers.)

GAS TURBINE ENGINES

Danger of icing is extremely great under conditions of high moisture and a temperature range of 0 degrees C. and —10 degrees C. On gas turbine engines, inlet duct icing can occur with OAT as high as 5 degrees C., *without the formation of ice on the aircraft's external surfaces.*

At temperatures below —12 degrees C., icing is not as severe a problem. Any ice which may form is of the "spear" or "streamline" type. This type formation is usually limited and any which forms can be easily removed with anti-icing systems.

Between —12 degrees C. and —5 degrees C., ice formation is of the intermediate type. It forms in relatively large pieces, is hard and is most difficult to remove with anti-icing. It can cause severe damage to gas turbine engines.

Above —5 degrees C., ice formation is of the mushroom type. Although relatively easy to remove, it forms more rapidly than other types. Sections of engine inlets can be bridged in a matter of seconds with this kind of icing.

Ice formation on fixed inlet screens and inlet guide vanes of gas turbine engines restricts inlet air flow. The compressor slows down and thrust decreases. The fuel control senses the slowdown and schedules a higher fuel flow. This causes egt to climb. Therefore, when flying in icing conditions, suspect inlet ice if egt begins increasing. Ice formation on inlet screens also disrupts air flow and causes compressor stalls.

Keep in mind, it's much easier to *prevent* ice formations than to remove them after they have formed. *Use the anti-icing systems.*

LANDING

All anti-icing equipment should be on and everything warmed up before starting descent through clouds. On reciprocating engines, exposure to carburetor ice rises sharply when throttle openings are reduced. Lower-powered descent in clouds and rain should always be made with carburetor heat on.

If you have flown through icing conditions, remember the effect on airfoils and carry an air speed margin for unpredicted stall speeds. Also, landing on wet or icy runways requires longer runs. Exercise great care when landing in high winds. Crosswinds are especially hazardous in winter because they may be coupled with icy runways and blowing snow.

WEATHER RULES

The following winter weather flying rules were adapted from Detachment 2, 16th Weather Squadron:

Rule 1: Be extra alert during morning flying periods for sudden weather changes.

Why? Morning flying periods are characterized by the poorest and most changeable weather of the day. The sun's heat does not have an appreciable effect much before noon. Consequently, nighttime fogs and low stratus clouds are slow to lift. Oftentimes, a temporary shift in the winds will blow a low stratus deck or fog bank away, only to have it come back in when least expected. The pilot who leaps just as the ceiling and visibility cross operating minimums is more often embarrassed than his wary brethren who wait for an added winter weather safety margin.

Rule 2: Be critical of visibilities reported as reduced by rain, drizzle or snow.

Why? Whenever a visibility of less than 6 miles is reported, the obstruction to visibility is included in the observation. (Thus the visibility will be reported "2 miles in rain, 1 mile in snow, 3 miles in light drizzle, etc.") Oftentimes the significance of this information is overlooked. Rain and snow have an invalidating effect on vision from the cockpit. For instance, visibility as seen by a weather observer in rain is not realistic from the viewpoint of the pilot who encounters the rain at tremendous speeds—sometimes equivalent to directing a fire hose at the window of the weather station. A weather observation wherein the reported visibility is obscured by precipitation should be viewed with some skepticism.

Rule 3: Exercise extreme care whenever the words "partial obscuration" or "obscuration" are contained in a weather report.

Why? The weather observer defines the ceiling and visibility by taking measurements in the vertical and horizontal. However, the pilot on his approach is interested in a factor known as slant range visibility, a factor the weather observer is unable to determine. Therefore, whenever an obscuration is reported, the pilot should be prepared for the possibility that the conditions he encounters will be poorer than those reported by the observer on the ground.

Rule 4: Where snow is forecast or listed as a possibility at destination, select an alternate where snow is definitely not expected and, if snow is encountered, proceed to it without delay.

Why? When snow reduces visibility to below minimums, it also reduces the radar capabilities of GCA (especially wet snow) by blurring the scopes, and it lowers the ceiling by obscurations. Icing may be encountered. Snow intensity is difficult to forecast and heavy snow often persists for a long period of time.

Rule 5: When in fixed wing aircraft, check runway conditions closely and cancel flight when the destination has ice-coated runways and temperatures are near freezing and/or rain or freezing rain is falling. Also cancel flight if fresh snow is on the runway or forecast to be on the runway.

Why? Ice and snow on runways are dangerous for landing and takeoffs. Snow is particularly slippery when temperatures are near freezing; wet snow on the runways offers little friction. Ice is always slick; and when it is wet with rain, it offers practically no friction.

Rule 6: Where weather at destination is reported below minimums in winter, proceed to alternate without delay.

Why? In summer, daytime weather deterioration such as stratus and rainshowers may quickly give way to improvement. In winter, the sun's heating is far less than in summer and often weather deterioration and then persistence of poor conditions occur in the daytime.

Rule 7: When in regions of suspected icing, climbing or letting down and upon landing, keep a safe margin of air speed and keep a minimum of extra exposed surfaces, such as wheels and flaps.

Why? Ice accumulation reduces dynamic lift and thus increases stalling speed. Extra exposed surfaces add to the amount of ice accumulation.

Rule 8: Don't be left out on a limb if your forecast "busts." Know all the possibilities—be sure your weather flying briefing includes all conceivable developments.

Why? A weather forecast is essentially a statement of chances. Although a given synoptic situation is likely to develop in one particular way, usually other possibilities are present. Thus, the pilot should know what to expect if a front, forecast to pass the destination before ETA, unaccountably slows down. Only the pilot briefed on all the probabilities is in a position to make favorable decisions affecting flight safety.

Rule 9: Be eternally vigilant; a little mistake can cause a big accident.

Why? Safety is no accident. Be weatherwise—fly safely!

Finally, let's keep in mind the important point made by the young captain we interviewed a short while ago—*if we are not going to take winter hazards seriously and be extremely thorough in all areas to ensure safe flight, then by all means, let's leave the flying to someone who will!*

Old Man Winter is here! He means you no harm, and he's not out to get you. But he *is* going to do his thing. You do yours—and have a HAPPY NEW YEAR!

Captain Charles W. Millican
Directorate for Technical Research & Applications, USAAAVS

Will Your Survival Equipment Function Properly When Needed?

UNDERARM LIFE PRESERVER

SUPPOSE YOU are a member of the next crew to fly an aircraft and your survival equipment includes the LPU-2/P or B-7 underarm life preserver. Are you confident that the preserver, if needed, will function properly? You can be if you make certain the preserver is properly maintained and inspected.

Preservers which have failed to function properly show a lack of proper care and maintenance. You can prevent this if you know all you need to know about the preservers. Test yourself by answering these questions:

1. What are the required inspection intervals for these pneumatic life preservers?

2. How often should inflation tests of the flotation cells be conducted?

3. Can the CO_2 cylinders which inflate the flotation cells be checked, and if so, how?

4. Are the preservers ever checked for CO_2 inflation? How is this test performed?

5. Are you able to look at your life preserver and know when it was last tested? Can you tell if it needs to be inspected?

6. May a punctured flotation cell be repaired? What are the repair limitations?

7. What is the service life of these preservers?

8. What effect does heat have on the life preservers?

9. Do you have the necessary publications which describe the maintenance and inspection of pneumatic life preservers?

Take care of your life preserver, and it will take care of you.

ANSWERS:

1. A preflight or daily inspection of the life preserver will be made before the first flight each day. This is a visual inspection for holes, tears, oil and grease. The harness should be checked for wear and condition of stitching. Also, inspection should ensure the closure pin is properly installed and the safety thread is intact.

2. An inflation test of the flotation cells should be made prior to issue and each 90 to 120 days thereafter. If the flotation cells are 4 years old or older (check date of manufacture), they will be inspected every 90 days to ensure serviceability. Once a year, a random sampling of 5 percent of all preservers will be inflated by CO_2 to ensure proper functioning of the CO_2 inflation system. Any evidence of failure of any one sample will require a CO_2 inflation inspection of all life preservers being inspected.

3. CO_2 cylinders should be weight checked before installation in inflators, using scales, FSN 6670-530-1114 or 6670-530-0996, calibrated in grams. Cylinders weighing less than the gross weight marked on the cylinders will be removed from service and condemned.

4. Same as in 2 above. However, the user must make sure that those preservers being CO_2 inflation tested have not been CO_2 inflated within 1 year. Repeated CO_2 inflations can induce leaks in the cell from cold cracking.

5. Upon completion of periodic inspection and test, each cell shall be marked to indicate date of inspection, using ¼-inch-high letters. The date and location of the inspection or test as well as a CO_2 inspection, if one has been performed, should be marked.

6. Punctures, cuts or tears measuring less than one-half inch in length may be patched, using neoprene cement, Military Specification MIL-C-5540, type II. The patches shall be round and fabricated from cell material. They must be large enough to extend more than 1 inch beyond each side of the hole. No more than two patches are allowed per cell.

PEARL'S

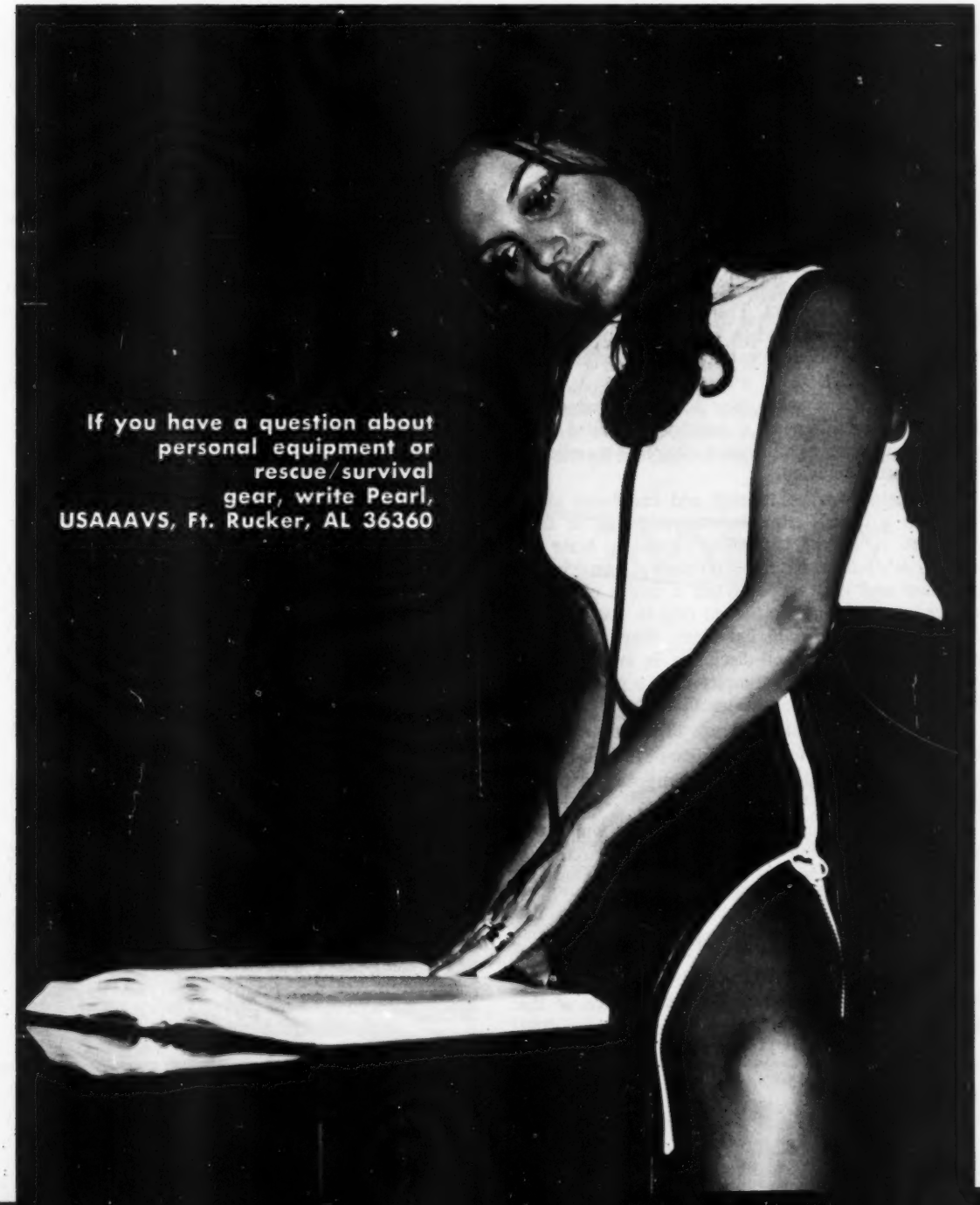
Personal Equipment & Rescue/Survival Lowdown

An inflation test must be performed after the patch has cured.

7. Service life of both harness and cells is dependent on condition rather than age. If major defects are found or if inspections indicate doubt of adequacy, the doubtful cells should be replaced.

8. CO_2 cylinders are used to inflate the cells of pneumatic life preservers. The pressure within these cylinders increases in direct proportion to temperature. Therefore, these preservers must never be stored in areas (aircraft, supply storage rooms, etc.) exposed to direct sunlight or high ambient temperatures. The CO_2 cylinders may explode.

9. Procedures for these various tests and inspections are contained in TM 55-1500-204-25/1 and TM 55-4220-201-12.



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Demonstrations of Flying Skill?

THERE'S A POPULAR TV show that always starts with an impossible mission. With careful planning of every detail, and usually an alternate plan, the show ends with the mission accomplished. Unfortunately, many aviation missions are in reverse order of the TV show.

Too many routine missions have ended in senseless and tragic accidents because an aviator was programmed to self-destruct. The programming is done by the aviator himself when he submits to an overwhelming desire to demonstrate his low-level flying skills.

When the desire takes over his better judgment, the aviator doesn't need a grandstand loaded with spectators to observe his demonstration. An audience of one is often sufficient.

An aviator can be trained and his flying skills honed to a razor's edge, but to train him in self-discipline is almost impossible. This he must do himself. It's human nature to pit desire against better judgment and knowledge. When a desire is strong, we tend to seek justification to rule in favor of the desire and against good judgment. When this happens to an aviator, self-discipline is crowded out and the programming is completed for a potential accident and possible self-destruction.

An aviator may have a desire to demonstrate his flying skills for various reasons. One of the most common reasons is to impress a passenger or a fellow aviator, or to boost his own ego.

Here is an account of an accident in which the pilot had been flying unnecessarily low, circling a house. Just prior to the accident, one of the last things he said was:

"This Is Where She Lives"

The UH-1 engine failed and the aircraft crashed into a city street and was destroyed. Three of the four crew members sustained major injuries. The reason for the engine failure was traced to an unsecured fuel line quick-disconnect which resulted in fuel starvation.

The helicopter was en route from an airfield to a pad on the other side of the city. The accident investigation board recorded the following:

Question: Did you go directly from the airfield to the pad?

Pilot: I made one 360-degree turn over the city because I was early and wanted to arrive on time.

Question: What was your altitude?

Copilot: We were flying at 150 feet.

Question: Do you know why you were circling?

Crew chief: Not really. We made two complete orbits and the pilot was showing the copilot a house he was interested in.

Question: Did the pilot say anything to the copilot?

Crew chief: He said something like, "This is where she lives."

Question: What can you tell us about the accident?

NCO club manager: On numerous occasions in the preceding week, I had noticed a helicopter of the same type circling over the club area toward the center of the business district. It was extremely low

over the club and seemed to go even lower as it went toward town. On the morning of the accident, a helicopter of the same type made two swings over the club. As it seemed to near the lowest point in its normal low orbit, I heard two loud crackling sounds and then silence.

This appears to have been a maintenance-induced materiel failure and at a reasonable altitude, normal emergency procedures would probably have gotten the aircraft safely to the ground. The pilot was apparently in a habit of trying to impress a girl friend by buzzing her house.

During the investigation of a similar accident, the board recorded the following statement from the crew chief:

"I Believe He Was Going to Fly Over Her House"

An OH-23G, with a pilot and crew chief aboard, took off for an administrative flight. Approximately 10 to 15 minutes later, the helicopter was turned to a westerly heading, approximately 75 feet above the ground. It then flew between two ridges and was approximately 20 feet above the ridgetops, maintaining level flight for approximately 200 yards where it struck three ⅛-inch steel telephone wires spanning the ridgelines.

The wires contacted the collective pitch control rod, cyclic control rods and transmission case. The wire then became entangled around the 5-inch drive, 1-inch drive shaft, tail boom, tail rotor and tail rotor gearbox. The tail rotor pitch control cable was broken.

Four hundred feet from the initial wire strike, the main rotor blade cut eight additional powerlines, then struck the face of a building 12 feet from the ground, breaking the mast. The wreckage came to rest approximately 10 feet inside the building, lying on its left side. The pilot received minor injuries and the crew chief received major injuries.

Low level flight was not necessary for this mission. If the pilot had been at a reasonable altitude, the wire strike would not have occurred.

Misplaced Confidence

Consider the following case of a UH-1H pilot who had a total of 540 flying hours. With a copilot, crew chief, gunner and passenger aboard, he was flying one of two helicopters which had completed their mission, refueled and were flying along a river when they came to a railroad bridge.

AC of trailing UH-1H: ". . . We both low-leveled down the river. I was taking photographs and my pilot was at the controls. As we approached the railroad bridge, the pilot of the lead ship called on UHF,

said he was going to fly under the bridge and asked if I would follow. I replied, 'No, I'm too short.'

"As we closed on the bridge, I had my pilot drop back to give the pilot of the lead ship room to climb over the bridge, as I did not think he would try to go under. As he got to the bridge and passed the critical point, we began a climb over the bridge. The lead pilot appeared to begin a flare and cyclic turn as he got to the low bridge. His turn was apparently started first and his flare about half completed when the main rotor hit the bridge and shattered. At this point, the aircraft hurdled forward and we lost sight of it as my aircraft crossed over the bridge at 100-200 feet.

"Reaching the far side of the bridge, I saw the aircraft lying on its top right quarter with a small fire in the hellhole. I took control, made a tight 270-degree turn and landed just as the crew chief jumped from the wrecked aircraft and a minor explosion started a fire over the whole rear half of the wreckage. . . ."

The pilot and gunner were killed in the impact and fire and the copilot had several broken bones and serious burn injuries. The crew chief and passenger escaped with minor injuries and the helicopter was a total loss.

Questions asked crew chief: "Did you hear any transmission from either of the pilots in the aircraft following you, attempting to discourage your pilot from flying under the bridge?"

"No, just the transmission about being too short to try it."

"Have you ever heard of anyone attempting to fly under this bridge?"

"I had heard that four aircraft had gone under the same bridge before, but I don't know whether they were from this unit or not. I had flown under the same bridge with the pilot about 3 weeks before the accident."

Flight surgeon: ". . . Any aviator who attempts to fly under a bridge just to show he can do it demonstrates a definite lack of maturity and professionalism."

The pilot of the trailing UH-1H used good judgment in choosing not to play follow the leader. The pilot of the lead UH-1H had apparently flown under the bridge on previous occasions and was overconfident.

Senseless and Tragic

A UH-1H aircraft commander was flying number three in a loose trail formation of four. As they flew across the water, the AC saw a destroyer in the bay. He veered to the right and descended to an altitude of 1 to 5 feet above the water. The crew chief and door gunner opened the cargo doors and the helicopter was flown from the bow to the stern of the destroyer parallel to the port side.

Reaching the stern of the ship, the AC made a cyclic climb to approximately 200 feet. He decreased air speed to about 40 knots at the top of the climb and made a sharp left turn. He then began a dive, with his flight path parallel to the starboard side of the destroyer. During descent, air speed increased to 95 to 100 knots and the AC and pilot were unable to recover from the descent. The helicopter hit the water with skids level and fire and explosion resulted.

The AC and pilot escaped from the submerged helicopter and were rescued by a boat from the destroyer. Both sustained major injuries. The crew chief's body was recovered 4 days later and the gunner's body was never found.

Both the AC and pilot demonstrated a lack of discipline by buzzing the destroyer, by varying the flight route from their predetermined course and by attempting an unauthorized maneuver.

"There's a Helicopter in Our Rear View Mirror!"

While in straight and level flight at approximately 15 feet, a UH-1D struck and broke two ⅜-inch powerlines strung across the highway. One of the powerlines struck and severed the UHF antenna and then struck and sawed through the right cyclic servo push-pull tube. The second wire broke on the swashplate. The severed push-pull tube would account for the apparent out-of-control condition after the wire strike.

The gunner was not strapped in his seat and was thrown out of the helicopter at impact. He died 5

days later. The pilot, copilot and crew chief sustained serious injuries.

Witness: "We were driving north at 4:10 p.m. My daughter saw a helicopter in the rear view mirror. It

came close with a roar and went over our car and started to land on the highway in front of us. It took off upward, curved left, headed south, hit a wire and nose dived. Some of it was falling apart as it came up from the highway. One man walked beside the highway and another man walked and fell down right away. Two men were caught in the helicopter. . . . We tried to keep the men lying down."

The accident investigation board listed the following cause factors:

"The cause of the wire strike was unauthorized contour flying in an area not designated as a contour flying area.

"The pilot has a recent history of low flying and buzzing to include one instance of low flying at night. No disciplinary action, other than a verbal admonishment, was taken against this aviator, in spite of several violations of flying regulations, all of which involved unauthorized low flying."

To Break the Monotony

A UH-1H with a crew of four and five passengers aboard was on a liaison mission. The AC was flying low level downstream about 50 feet over a river. A passenger spotted some figures with weapons and the AC turned the aircraft around to investigate. He climbed to 250 feet, made a sharp left turn, entered a dive and struck the water in a nose-low attitude at an air speed of 60 to 80 knots with engine rpm deteriorating below 6200.

The aircraft, crew chief, gunner and three passengers were not recovered. The pilot and one passenger sustained major injuries, and the AC and one passenger had minor injuries.

Question asked by accident investigation board: Why did you decide to fly low level?

AC: To break the monotony.

Etiology of a Midair Collision

The day had been long and tiring. The flight leader called the tower on the way home and requested permission for a flyby. "Always good for morale," he thought. The five slicks locked in echelon right. Before reaching the end of the runway, Chuck 4 collided with Chuck 3. The results included four fatalities and two postcrash fires.

One of the major factors was an attitude of overconfidence, with subsequent carelessness on the part of the pilot of Chuck 4. He was one of the most experienced aviators in the unit, with more than 1,500 hours in helicopters and 1,336 hours during his current 11-month tour. He had been averaging more than 120 hours monthly and had no previous accidents. After considerable discussion with him and his fellow aviators, it became obvious he considered himself an exceptionally capable aviator and undoubtedly took great pride in his flying record and prowess. His platoon leaders and others had noted he was rather resistant to suggestions regarding his flying techniques and habits. He had been admonished on several occasions that he was flying too close during formation flights. On the day of the accident, he had been told twice, once earlier in the day and again just prior to the accident, that he was flying unusually close. It would seem his overconfident attitude allowed him to become unusually careless about keeping his proper distance between helicopters.

The esprit of the unit was high and the encouragement of the flight leader to "close it up and look real good" probably caused the pilots to form a tighter formation than usual. In fact, most of the aviators and crew members interviewed remarked that it was one of the tightest formations they had experienced.

In each of the above accidents, an aviator had a desire to impress someone by demonstrating his flying skills. In each case, all the aviator demonstrated was lack of professionalism, lack of self-discipline, lack of good judgment and immaturity.

Unfortunately, the rest of the crew can't get out and walk when the pilot programs himself for destruction. All too often the crew pays for the pilot's poor judgment. When a pilot causes the death of a crewman because he rules in favor of a childish desire to demonstrate his flying skill, what does he think about when he looks at himself in the mirror? Ask yourself that question the next time you want to impress someone with your flying skill. Demonstrate your flying skill by making certain your crew and aircraft arrive safely after each mission. That takes professional skill.

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STATIC DISPLAYS AND AR 360-61

Fourteen spectators were injured by a helicopter on static display at an air show

AS DEFINED BY AR 360-61, Community Relations, "Static display is a ground display of any aircraft, and its related equipment not involving flight, taxiing, or starting of engines. The aircraft must be in place with power off prior to assembly of spectators unless the aircraft can be towed or otherwise transported into the area with safety to spectators observed, and may not be moved until spectators have departed."

The demonstration flights were over, but approximately 100 spectators were still viewing the equipment and aircraft on static display at a civil air show. One of the display aircraft was an Army CH-54B which was to be ferried to its home base after the show. Departure time had been scheduled for 1630, but because the area was still congested, takeoff time was rescheduled for 1715 to 1730 hours.

Earlier, the pilot had requested a tug and tow bar to move the aircraft from the display area, but since neither was available, he decided to back the aircraft out to the taxiway. During this maneuver, the pilot erroneously thought the nose wheel had to be swiveled 180 degrees to the trail position. He applied excessive left cyclic and right pedal and a minimum amount of pitch to lighten and turn the nose wheel. The nose wheel lifted off the ground approximately 6 to 25 inches while the main gear remained on the ground without moving, indicating that the toe brakes may have been applied.

The pilot then lowered the collective abruptly, which caused the rotor system to overshoot the normal plane. The main rotor blades struck the number six section of the tail rotor drive shaft and fuselage between stations 749 and 767 and severed the tail rotor drive shaft, causing structural failure of the tail boom. Parts were scattered nearby and the number one and two pockets of one main rotor blade were thrown about 550 yards from the scene of the accident. Fourteen spectators were injured either from parts flung from the aircraft or from falling to the ground to take cover. Minor damage to two civilian aircraft in the immediate area was also reported.

The accident investigation board determined that crew, training and supervisory errors caused this accident. The pilot used improper procedures to back taxi the aircraft because of lack of formal training in this maneuver, and a lack of published procedures in TMs 55-1520-217-10/2 and 55-1520-217-10CL/2. Back taxiing the aircraft was not covered in the unit SOP because the maneuver is not outlined in TM 55-1520-217-10/2 and is not taught at the U. S. Army Aviation School, Ft. Rucker, AL, or at the unit level. Also, the crew's alternative options were reduced by the close proximity of the spectators and small aircraft on the ramp.

The board recommended that (1) air crews be given instructions in the proper procedures for back taxiing the CH-54B and that these instructions be incorporated in the appropriate TMs and the transition courses at Ft. Rucker; (2) all pilots be made aware of paragraph 4-1c(2), AR 360-61, prior to a mission involving civil static displays; and (3) unit SOPs be developed as guidance for crews involved in static displays and demonstrations.

It was the opinion of the investigating board that neither the pilot nor copilot was familiar with AR 360-61. Their attempt to move the aircraft from the congested area limited their options and forced them to perform a maneuver in which they were not proficient.

Taking this into consideration, we can logically assume that, had this regulation been complied with, this major accident and the injuries would have been prevented.

The policy of the Department of the Army is to support events in a civilian community to enhance the effectiveness of the Army and its relations with the public. Safety of spectators is of utmost importance during such displays, and commanders must ensure compliance with AR 360-61. They must establish, operate and supervise these programs within their commands to prevent accidents from similar causes and to achieve a congenial relationship with the civilian domain.

USAASO Sez

The U. S. Army Aeronautical Services Office discusses

On Cruise Clearance: One of the more simple clearances engenders more questions than you can imagine. To clear the air, the following question was posed to the Federal Aviation Administration (FAA) Air Traffic Service: "Once a pilot is given a cruise clearance with an assigned altitude, is he required to go to the assigned altitude, or may he elect, on his own initiative, to stay at a lower altitude based upon the fact that there is the implication with a cruise clearance that all of the airspace from the assigned altitude on down is his?"

FAA replied: "Cruise when used in an air traffic control clearance means, in part, that climb to and descent from the assigned altitude may be made at pilot's discretion. As outlined in Advisory Circular 90-54, the airspace from the assigned altitude down to the applicable minimum enroute IFR altitude (MEA)/minimum obstruction clearance altitude (MOCA) is free of any known IFR traffic. Although the cruise clearance gives the pilot broad discretion in climbing and descending, and while it is true that the clearance indicates that the airspace from the assigned altitude to the MEA/MOCA is free of known IFR traffic, we would normally expect the pilot to cruise at the assigned altitude; if he should desire to operate at an altitude other than that assigned, to advise air traffic control and request an amended clearance. Sections 91.75, 91.79, 91.119 and all other pertinent portions of the Federal Aviation Regulations, of course, continue to apply. This technique provides the best utilization of airspace for both the user and air traffic control. Further, it assists the controller in providing air traffic control services such as IFR advisories, merging target procedures, etc., to other aircraft."

USAASO Sez: It is just plain common sense to keep the controllers informed of your intentions—both for your own protection as well as others using the airspace!

Wake Turbulence: In the last few years a lot has been said about the dangers of wake turbulence and what causes it. However, as pilots you know that you have certain responsibilities concerning wake turbulence separation—*OR DO YOU?* What are your responsibilities? Stuck for an answer? Okay, here's the story:

a. In operations conducted behind heavy jet aircraft, the pilot's acceptance of traffic information and instructions to follow the heavy jet or provide visual separation from it is considered by the controller as acknowledgment that the pilot sees the heavy jet and accepts the responsibility of providing his own wake turbulence separation.

b. The acceptance of a visual approach clearance by a pilot is considered by the controller as acknowledgement that the pilot positioned behind a preceding aircraft will ensure a safe landing or takeoff interval and accepts the responsibility of providing his own wake turbulence separation.

c. The pilot may request a waiver to the 2 minute wake turbulence separation minimum from ATC on departure; however, by doing so the pilot in command accepts the responsibility of providing his own wake turbulence separation.

Are you now ready to accept responsibility for your own wake turbulence separation? If you avoid encounters below and behind the generating aircraft, especially at low altitudes where even a momentary wake encounter could be hazardous, you can probably answer the question affirmatively. The best bet is to study and know your responsibilities regarding wake turbulence separation and be aware of the causes and the dangers involved. It may mean *your* life! Be always alert and wake turbulence conscious and make sure your landing is a safe one!

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New Year Revelation

BEGINNING ON 1 January 1973 students registered in nonresident branch officer advanced and command and general staff officer courses will be required to show their ability to write by completing a writing project. As desired by school commandants, the project may be a staff study, monograph or an article for publication in a military professional magazine like the U. S. ARMY AVIATION DIGEST, an official Department of the Army periodical.

The benefits of writing for the AVIATION DIGEST are numerous, both for the writer and the magazine. There is the possibility of winning a $25 U. S. Savings Bond for the best article of the month and even more in the annual awards contest. Also, there is the enriching satisfaction of having your thoughts and experiences published in a widely distributed magazine while satisfying a requirement for the completion of your course.

If you want your article printed in the DIGEST you have a better chance of getting it published by following our editorial slant. Keeping in mind that readers of the AVIATION DIGEST range from the novice to the professional. The magazine covers a wide range of subjects including those of interest to officers, enlisted and civilians in the aviation program.

We prefer that manuscripts be submitted on standard bond paper, typed double spaced. But, if you don't have access to a typewriter we will be happy to receive your manuscript handwritten. Don't leave out important facts just for the sake of brevity. The choice of words is not important as we would prefer the article reflect the author's own style. We reserve the right to edit each article for style and readability.

We encourage you to send supporting photographs and artwork. Black and white glossy (8 X 10 inch) photographs are best suited for publication. Drawings need not be professional—our art department will redraw them.

What you write will probably be determined by the subject of your course. If you have a choice, read several recent issues of the DIGEST to determine our range of subjects. Remember, we work about 4 months ahead so our future needs are not necessarily reflected in current issues. If a story is good we can hold it for future use.

Normally we do not accept copies of articles but if that is all you have available, go ahead and send it to us. All we ask is your article not be sent for publication to another magazine. Good luck!

ORVAL RIGHT
Chief Advisor on Matters of Aviation

Colonel R. D. Schultz, Canadian Forces Director of Flight Safety, writing in a recent issue of FLIGHT COMMENT, had some very interesting observations about supervisors and flight safety which I felt were appropriate to pass on to men of good will before the beginning of a new year.

SINCERITY—OR HYPOCRISY?

Are you a believer in the flight safety program as an essential part of well managed air operations or do you really consider it just another impediment to getting the job done?

There is evidence that some supervisors of aircraft operations let their aversion to the word safety influence them to such an extent that they leave the prevention programs, such as they are, to the flight safety officers, without positive direction or support. Such an approach is guaranteed to fail because safety officers do not have the responsibility for getting the job done or for establishing policy on how it is to be achieved.

If you are one of the people, supervisor or not, who don't believe that a positive flight safety program enhances mission accomplishment, then you are a safety problem—how much of a problem depends on your position in the organization and on the way in which you approach the issue. If you admit that you have reservations or are against the program in principle, at least we know where you stand and can try to change your mind. On the other hand, if you make a pretense at supporting the program without really believing in it, you are a hypocrite and such an attitude will surely have a negative influence on others. It is this cancerous influence which is of greatest concern because it can destroy the effectiveness of any accident prevention program through the loss of trust and confidence on the part of everyone concerned.

We have over 50 years of experience that proves that a sincere approach to flight safety makes sense. How then can we afford people in the air operations organization who have a negative attitude towards accident prevention? We can't. So let's take the positive approach without qualification.